The Electrical World.

VOL. XXVII. NEW YORK, JANUARY 4, 1896. No. 1.

PUBLISHED EVERY SATURDAY BY

THE W. J. JOHNSTON COMPANY,

253 Broadway, New York.

Established 1874. Incorporated 1889.

Telephone Call: Cortlandt 924. Cable Address: "Electrical," New York

New England Office, 620 Atlantic Ave., Boston.
Western Office, 936 Monadnock Block, Chicago.
Philadelphia Office, 927 Chestnut Street.

SUBSCRIPTION IN ADVANCE, ONE YEAR, $3.00,

In the United States, Canada or Mexico; other foreign countries, $6

In requesting your address changed give OLD as well as new address.

Now in its third decade, THE ELECTRICAL WORLD is the Pioneer Electrical Journal of America, and has well maintained its lead. It has the largest Circulation of any electrical periodical, and is the best Advertising Medium.

THE ELECTRICAL WORLD'S Advertising Rates are much lower than those of any other similar publication, circulation considered, and vary according to space, position and number of insertions. Quotations promptly furnished.

Address and make drafts, orders, etc., payable to

THE ELECTRICAL WORLD,

253 Broadway, New York.

VOL. XXVII. NEW YORK, JANUARY 4, 1896. No. 1.

CONTENTS.

Editorial 1
A Review of the Year 3
Central Station Working—I., by Cecil P. Poole 5
The Lawrence Accumulator Station 7
Changes in Underwriters' Rules 7
Electrical Matters at Niagara Falls, by Orrin E. Dunlap 8
Notes on Accumulator Testing—I., by Carl Hering 9
Edison's Plans for War 10
Electricity in the Capitol at Washington, by George H. Draper 11
Design of a 1-kw Motor, by Alton D. Adams 12
The Invention of the Electromagnetic Telegraph, by Mary A. Henry, Edward L. Morse and Stephen Vail 13
Current Splitting, by Reginald A. Fessenden 15
Digest of Current Technical Electrical Literature, Compiled by Carl Hering 16
New Books 22
A Great Manufacturing Establishment 23
Pressure-Regulating Valve 24
The Metropolitan Telephone System 24
A New Alternating-Current Arc Lamp 24
An Electric Bicycle Lamp 25
Wire Reel and Meter 25
Air-Brake Motors 25
Indestructible Insulator and Pin 26
Niagara Falls Turbines 26
Steam-Pipe and Boiler Covering 27
The Telephone Applied to Electric Roads 27
Vitrified Terra-Cotta Conduit 28
The Business World, 1895–1896 29
DEPARTMENTS:
Financial Intelligence 40
Special Correspondence 40
General News of the Week 41
Trade and Industrial Notes 43
Business Notices 43
Illustrated Record of Electrical Patents 43

THE BUSINESS WORLD.

This issue contains a feature in some sense unique, consisting of expressions of views from members of the commercial electrical fraternity relating to the business situation, and including statements concerning their own particular field of commercial activity. While our advertising columns furnish readers means to keep informed on many of the latter points, yet, as presented together in these columns as a New Year's greeting, they will, we believe, prove of interest to all as a symposium reflecting the vigorous and enterprising business spirit which animates our electrical industries. The variety of the branches, and the large number of other than purely electrical ones which cater to the electrical field, is here made evident; and not without interest is the clear-cut and keen manner in which the writers express themselves. While perhaps a certain monotony may be noticed in the claims for superiority, yet this is natural on the part of men who have the courage of their convictions, and whose policy does not include the element of half-hearted support of objects to which they are devoted.

STORAGE BATTERIES.

We print elsewhere in this issue two articles dealing with the storage battery from two different standpoints—its application and its testing. The former consists of a description of a battery forming part of the Lawrence, Mass., Edison plant, and furnishes an admirable illustration of one of the uses in central-station work. As will be seen, the batteries are intended to take the peak of the load, which exists during several hours of the day. While thus obviating the necessity of a complete boiler, engine and electrical equipment sufficient to provide for the peak, the great additional advantage is presented of enabling the machinery to be worked at an economical point during the hours of light load. That the desired object has been fully accomplished is evident from further additions that have been made to the battery plant. It will be noted that the original plant was so designed as to admit of being doubled by the mere addition of plates, which is an interesting point. The other article referred to, "Notes on Accumulator Testing," of which the first half is published in this issue, will be found of much interest as it includes a complete code of procedure, and one, moreover, founded upon practical testing experience. That the art of testing accumulators is one not as simple as would appear, has been demonstrated by the considerable discordances that may be noticed in published tests. There are several factors entering into accumulators that admit of different handling, and therefore comparisons between different tests are often valueless through these factors being treated in different manners. As pointed out by Mr. Hering, tests of accumulators may be made showing an efficiency in the neighborhood of 100 per cent., though the efficiency under actual working conditions may not be unusual; the extreme importance of approaching these conditions in testing is, therefore, obvious. For correct comparisons, as pointed out, it may also be necessary to submit different accumulators to different conditions; again, comparisons should be made upon a basis applicable to the type of cell dealt with, for it is easily seen that on the basis of amperes per pound of plate a cell thus tested would be placed at a great disadvantage with another having lighter plates, though the former might be much the more efficient cell.

CENTRAL-STATION WORKING.

In this issue is begun a series of articles devoted more particularly to the practical aspects of central-station operation and including points on station design and other practical matters of interest to superintendents and managers of electric lighting and power plants. In the operation of such plants doubtless every superintendent or manager has had experiences which would be of value to others, but

heretofore information relating to these special cases has but rarely found its way into print. The scope of the series includes the boiler room, the engine and dynamo rooms, and the line, and having relation to matters of a special rather than general character, such as "wrinkles" in operation, working conveniences and expedients, accounts of changes whereby increased economy has been obtained, etc. We hope that much information will be included concerning boiler-room economy, as this is the department of station plants, which is generally the weakest; opinions in regard to types of boilers, methods of firing, automatic feeding, the use of blowers and the disposition of boilers thrown out during hours of light load would be of particular value. As to the engine department, opinions based upon practice would be welcomed as to the relative advantages in particular cases of simple engines, tandem and cross-compound, condensing and non-condensing, fast and slow running, engines, types of governors, valves and flywheels, etc. Owing to the extensive overhauling of stations to provide for increase of capacity or changes of type, almost every station manager has been able to form opinions in regard to one or more of these points. In the electrical department ideas would be of much interest relating to the care and operation of motors and dynamos, as well as information concerning parallel running, such as methods of throwing in and out, regulation, etc.; switchboard dispositions and manipulation, etc.; criticisms based upon experience with electrical machinery in regard to mechanical design, and with suggestions as to desirable changes, in order better to meet practical conditions, etc. The latter forms, in particular, an interesting subject, as central-station men have had no voice in regard to the requirements which practice has pointed out as desirable in the design of such machinery, and their opinions, based upon practical working, would be of much value. The line should give occasion for many practical hints, with reference to insulation, care of transformers and line provision for safety against high voltages, expedients and special dispositions, etc., and supplementary to this head might be included station and house wiring, practice with respect to renewing incandescent lamps, care of arc lamps, etc. We have sketched in rather full outline the plan of the series, for although many of the articles which it will include are provided for, we shall be pleased to receive further contributions, and, particularly, comments on and extensions to, the information which they will contain. The outline given need not be accepted as inclusive; doubtless other points of value to station managers and superintendents have been met within the practical experience of many. We hope that modesty will not prevent practical men from giving the result of their experience, and it should be borne in mind that what may appear to them to be perfectly obvious, may yet be of value to others, or what is old practice in one locality may be unknown in others.

THE NEW YEAR.

The past year, while not as successful as might have been wished, yet offers promise for the year upon which we are now entering. While the recovery has been slow from the business demoralization brought about by the panic of 1893, yet it has been sure, and at present the electrical industry may be said to be established upon a firmer basis than at any other time in its history. As to what we may expect the new year will hold forth in electrical advances, there does not appear that anything startling may be anticipated, but rather that it will be another period of advances along well-defined lines, and particularly in the way of engineering perfection. The new field which the electric furnace has opened, and which has already received several interesting developments at Niagara, offers many promises, the limits to which the process may be carried, though but ill-defined at present, seeming to have a very wide horizon. It is in the application of electric power, and in electric railway development, however, that we may expect to see the greatest progress. The success of the Niagara plant has been so complete, that nothing now remains for demonstration, as far as the production and field for application of large quantities of electricity is concerned, though until the completion of the Buffalo-Niagara transmission project there will be probably no extensive advance in that direction. As, however, the year will see the work executed, the carpers who require an actual practical demonstration will have their fears set at rest, and new schemes will be commenced, if not completed, during that period. The greatest development of all will undoubtedly be in the electric railway field, as the success of the Chicago elevated electric road and of the Lenox Avenue conduit road have opened up two magnificent fields, and the latter, in particular, will receive a great impetus, particularly in New York City. Another branch that will be given a great impetus is that relating to the employment of electricity for motive power on the spurs, branches and shorter lines of steam roads; we may even expect to see electricity employed in part on main steam lines where passenger traffic is heavy, as outlined in the Niagara paper of Dr. Duncan. It is also quite probable that during the year the alternating current will be applied to electric traction, either directly or in connection with rotary transformers supplying continuous current to the line. The latter method is so obvious, and apparently so simple of application, that it promises to play a large part in the operation of even urban lines. The great amount of thought being given to the improvement of the incandescent lamp may result in a notable increase in economy, while it seems certain that the end of the year will witness a considerable increase in the application by central-station managers of the principles of economy in its operation. "Cold" light appears to be as far away as ever, commercially speaking, but it is to be hoped that the work of Tesla, Moore, Ebert and others may be advanced to a practical stage during the year. In theory the brightest prospects lay in the direction of Hertzian phenomena, though the more we know of these, the more the great work of Maxwell and Hertz seems almost exhaustive, leaving little, perhaps, that is original to be developed.

The National Electrical Exposition Company.

Mr. Clarence E. Stump, who needs no introduction to the electrical field, has been appointed general manager to the Electrical Exposition which is to be held in New York City, commencing May 4 and continuing until the first of June.

Numerous inquiries for information regarding space and other details are daily being received by the management, and a large number of prominent manufacturers have already closed contracts, while many additional firms have signified their intention to make extensive exhibits. The success of the enterprise is assured, and all indications point to the largest and most interesting display of electrical apparatus and supplies ever made in this country.

Municipal Lighting in Philadelphia.

President Marks' letter to the stockholders of the Edison Electric Light Company, says the Philadelphia *Ledger*, makes it plain that the Electric Combine has captured that company, or, at least, acquired so much power over it as to prevent its bidding against the Combine's monopoly of the city's electric lighting. It also shows the unwisdom of the city's course in allowing no time for preparation between the awarding of contracts for electric lighting and the beginning of the service—a course which plays directly into the hands of the Combine, since it gives a possibly successful competitor no chance to prepare for doing the work. The combination is developing an octopus-like character which makes it imperative for the city to establish and maintain its own plants for electric lighting, since it is plain that until that is done it must submit to extortion which no competition can be depended on to overcome.

Engineering at Harvard University.

The subjects taught at Harvard University under the head of engineering now number 42, some of them extending throughout the year, others for one term only. The work is given by 18 instructors and assistants. Four-year courses are given in four branches of engineering: civil, mechanical, electrical and mining. Courses for electrical and mechanical engineering are provided for in the laboratory equipment and in workshop visits. The workshop methods are given at the Rindge Manual Training School, and the experimental courses in connection with the steam engine and mechanical engineering are given in the old gymnasium. Electrical machinery is located in the addition to the Scientific School building, where the practical instruction is given.

Record of the Past Year.

The year 1895, as far as concerns electricity, will go down to posterity marked rather by solid engineering advances than characterized by achievements of a purely original kind. With respect to the business situation throughout the year, it may be said that while not satisfactory, and in some respects far from being so, yet much improvement was shown over the previous year and the final days contained good promise for the future, unless such a governmental financial policy shall prevail as will bring about general business demoralization.

Of the various departments of electrical activity, that relating to electric railways was probably the most prominent. In glancing over the pages of THE ELECTRICAL WORLD of the last year two events of the first magnitude loom up in this connection—the starting of the B. & O. Belt Electric Line, operated by electric locomotives (described July 13), and the inauguration of the first elevated electric railway system in this country, at Chicago (described May 4). Of scarcely less importance was the commencement of conduit electric traction on the New York Lenox Avenue road, the success of which has led to official announcements of the adoption of the same or a similar system by all the important surface roads in New York City. Still another event that attracted the widest attention was the trial of high-speed traction at Nantasket Beach (*E. W.*, July 6), which satisfactorily demonstrated the superiority of electrical power for this purpose. The successful operation at Washington of the Connett-Budapest system (*E. W.*, Nov. 16) has been a further illustration of how utterly unfounded were the suspicions with which the simple underground trolley conduit was formerly regarded.

Among other street railway matters to be mentioned are the putting in operation of storage battery traction on the New York Madison Avenue street railways; the decision to adopt the storage battery for the source of motive power on the Thirty-fourth Street ferry branch of the New York Elevated Railway, and the commencement of work in that city on a closed conduit line. The alternating-current, rotary-transformer railway system at Norwich, Conn., should not be passed by, as it is a first step in a direction that will doubtless be followed by many others.

Of the various contributions to the literature of the subject of the electric railway a notable one was the address of Dr. Duncan at the Niagara meeting of the American Institute of Electrical Engineers, "On the Substitution of Electricity for Steam in Railway Practice" (*E. W.*, July 6), which clearly presented the conditions affecting such substitution, and offered conclusions which, though perhaps not satisfactory to the electric railway enthusiast, yet gave vast promise for the future. During the year the subject of electrolytic corrosion by ground railway currents has attracted much attention; among the notable contributions on the subject are those from the pens of Prof. A. J. Rowland (*E. W.*, Feb. 2), W. Stuart-Smith (*E. W.*, March 23, April 26 and May 11), M. Hooper (May 25), F. Bain (May 11). Another article of marked value is that of the Belgian engineer. Paul Hoho, on the subject of skidding with two or more motors (*E. W.*, Aug. 24).

In the commercial field, the Westinghouse-Baldwin combination for the manufacture of electric locomotives brought the public to realize the importance of this new branch in electric traction. The feature of trolley parties, which was generally introduced during the year, is an interesting as well as profitable addition to electric railway operation, while the great Brooklyn trolley strike in January (*E. W.*, Feb. 2), and the one just ended at Philadelphia, made their showing on the opposite side of the ledger.

Electric lighting presented no marked developments during the year, if we except the progress made in the education of central station men with respect to the utility of storage battery auxiliaries. The excellent results achieved during the year with such plants in the New York, Brooklyn, Boston and Lawrence Edison stations, and the publicity which the subject received from the discussion on storage batteries at the November meeting of the American Institute of Electrical Engineers, will probably fix 1895 as the missionary year to what promises to be a wholesale conversion of central station managers to the use of the storage battery. Another subject brought well forward during the year was that of gas engine central stations, the success of which in Europe is finally causing our central station men to inquire if the gas engine presents any advantages for use on this side of the water for the same purpose. The growth of decorative incandescent lighting has been more extensive during the past year than in perhaps the entire preceding period, and promises still further growth for the future (*E. W.*, Jan. 12, May 25, Sept. 14).

No event during the year was regarded with more interest than the starting of the great Niagara Falls Power Plant (*E. W.*, July 6), which, though in operation less than a half-year, has already resulted in the development of new industries, as may be seen by reference to the article in this issue, giving an account of the electrical industries of Niagara. Owing to the disagreement in regard to the terms of the Buffalo franchise, the hoped-for demonstration of the electrical transmission of power on a huge scale is still lacking, but will probably be made during the coming year. Among transmission plants put in operation during the year are those at Silver Lake, (*E. W.*, Aug. 24), Sacramento-Folsom, Cal. (*E. W.*, April 6), and others of lesser importance, and several large projects were begun during the year but not yet finished. The subject of electric power for factories and workshops received much attention, and many installations were made during the year. The satisfaction given in every instance has been marked, and the past year will be regarded also as a red-letter epoch in this branch. Of the contributions to the literature of the subject of electric power transmission and utilization may be mentioned the Niagara paper of Prof. Crocker (*E. W.*, July 6), on the application of electric power in factories, the papers read at the same meeting by Mr. L. B. Stillwell and W. L. R. Emmet (*E. W.*, Nov. 16). The Niagara paper of Dr. Emery on the "Cost of Steam Power," should not be forgotten, on account of its indirect bearing on the subject.

In important patent decisions the year has been exceedingly fruitful, beginning with the important Bate Refrigerating Case (*E. W.*, March. 3) and ending with the fundamental trolley decision, (*E. W.*, Dec. 21) which is only second to the incandescent lamp decision of 1891, if at all inferior in importance. In June (*E. W.*, June 15, 22) came the celebrated Berliner decision, re-establishing the telephone monopoly, and only equalled in importance, as far as the great mass of the public is concerned, by Judge Carpenter's decision on the same subject the preceding year. Among other important cases decided was that awarding priority to Van Depoele for certain overhead railway devices (*E. W.*, July 20) the annulment of the two-carbon arc lamp patents (*E. W.*, Aug. 3), and the confirmation of the verdicts of lower courts in the arc-regulator and Sawyer-Man filament cases.

To periodical literature there have been a number of notable contributions, aside from those already named above, particularly in the field of alternating currents. Of these we may name the papers read by Steinmetz at the Niagara meeting of the A. I. E. E. on "The Theory of the Alternating Current Transformer" and on "Features of Alternating Current Systems," the former establishing general equations of wide application, and the latter laying down distinctions between various alternating systems. Among those which have appeared in our columns, we may enumerate the series of Messrs. Houston and Kennelly on "Electrodynamic Machinery," of Dr. Bell on the "Electrical Transmission of Power," and of Mr. A. E. Wiener on "Practical Notes on Dynamo Calculation." Of other articles are the following: Pupin on "Electrical Consonance" (Feb. 1), Merrill on "Coal Consumption of Central Stations" (Feb. 23), Kennelly and Goelet's report on electrocution (Feb. 16); on the "Theory of Alternating Machinery," by Mershon (June 15), Rothert (April 27), Brousson (Aug. 31) Behn-Eschenberg (June 29), Chrytæus (April 13) and Bedell and Ryan (March 30); on "Dimensional Formulas and Units;" by Fessenden (May 4, 19, June 29, Aug. 24), Wolcott (June 18, July 13) and Thomas (Nov. 23); Kimball on "Capacity Effects in Wire Coils" (July 13), Dunstan on "Residual Charges of Condensors" (July 6), Rosa on "Self Inductance and Capacity" (June 8), and others. Special mention should be made of the several original contributions of Houston and Kennelly to Magnetism (May 18, June 1 and Nov. 16), which notably simplify magnetic determinations coming within their scope; and of the Institute paper "On Resonance," by the same writers.

An interesting discussion on the "Definition of Polyphase Currents" (commenced March 9), brought forth opinions on the point at issue from a large number of writers, including Steinmetz, Blondel, Ryan, Jackson Nipher, Fessenden, Stine, Gutmann and others.

Of systems placed before the electrical public during the year, two were of striking originality—the monocyclic system of distribution of light and power of Steinmetz (*E. W.*, Feb. 9), and the phasing transformer of Bradley. Calcic carbide, or rather its product, acetylene gas, also attracted much attention from the claims made as to the cheapness with which illumination could be furnished through its use. THE ELECTRICAL WORLD early pointed out (Feb. 16, March 2, March 16, May 11), the equivocal character of these claims as far as related to the estimated cost of the electrical energy necessary for its production, which later estimates has confirmed.

In electro-chemistry considerable commercial advances have been made, if we are to include under that head the various processes involving the use of the electric arc, several of which have been applied at Niagara, and preparations made for putting into operation

others. As to the production of electricity direct from fuel without heat or loss in the electrolyte, the promise of the German electrochemists has not been made good, and no advances during the year appear to have been recorded. Contributions to the subject have been made by Reed (*E. W.*, March 16, April 6, 20, June 15), and in a notable discussion concerning Borcher's battery (March 16, April 6) but the latter was destructive instead of indicating advance.

Much attention has been given to storage batteries, both in a commercial way and with respect to their applications. In addition to their use in central-station work and in electric traction, they have begun to be largely adopted for telegraphic purposes, and their employment in isolated installations has largely extended.

Mention should not be omitted of the important discussion on the "Invention of the Electromagnetic Telegraph," in which some of the principal telegraphic authorities of the world participated. The data thus collected and the sifting which it received, have done much toward clearing up the question, and furnish future historians of the telegraph a mine of information.

The subject of magnetic units again came to the front during the year, through the action of the British Association in proposing several for general adoption. As the action of the American Institute of Electrical Engineers in adopting the C. G. S. magnetic units as practical units, and assigning names to them, had apparently been approved by the American electrical public, and as these have already entered largely into use, there is little or no prospect of the "1895 B. A. units" receiving adoption in this country, and it is extremely questionable whether they will be viewed with greater favor on the Continent.

The annual meetings of the various societies and associations during the year were highly successful. The meeting of the American Institute of Electrical Engineers at Niagara was the most successful in its history, and the occasion was otherwise made a memorable one through the members being accorded the first opportunity offered to inspect the Niagara plant in operation. The National Electric Light Convention at Cleveland had a large and enthusiastic attendance, and the papers read and discussions held were of the first importance. At this convention the monocyclic system was presented to the commercial world by Dr. Bell; Messrs. Houston and Kennelly described a new form of illuminometer, and most interesting discussions were held, among others, on the subjects of arc carbons and dynamos. The Street Railway Convention at Montreal was also highly successful, though the papers read did not come up to the usual standard, indicated a falling off in some respects. The meeting of the American Association for the Advancement of Science, at Springfield, touched but lightly on electricity; nevertheless, two papers by Dr. Pupin, and another on the electrolytic production of white lead attracted attention. The Canadian Association, at Ottawa (*E. W.*, Sept. 28), and the Northwestern Electrical Association, at Milwaukee and Chicago (*E. W.*, Jan. 26, July 27), also participated in the successes of the year, as did the Wilkesbarre and Albany meetings of the Pennsylvania State, and New York State Street, Railway Associations.

Possibilities of Telegráphy.

In the New Year number of the New York *Herald*, Mr. Charles Cuttriss, electrician of the Commercial Cable Company, says that he thinks the most needed improvement in telegraphic service is to place underground cables along the railroad tracks between important business centres, thus tending to make the service most reliable; and the perfection of a rapid Page printing telegraphic machine, with keyboard adapted to the use of any one who can use a typewriter, would tend to make a service that could be used by the layman in small towns without going to the expense of maintaining a regular operator. These points, Mr. Cuttriss says, are now being considered, and their perfection is only a matter of time.

Engineering Students.

Engineering students divide themselves, says Prof. Ira N. Hollis, in a recent article in the *Harvard Graduates' Magazine*, into three classes. First, those who have strong talent for engineering; second, those who have preference for something else but drift into it by force of circumstances or by parental wish; third, those who have a thorough ability for anything they undertake. Time would be spared to the two last named classes, he says, by three years previously spent in a college classical course, with the additional opportunities to adjust themselves to their surroundings and to think about their real taste.

Edison as Sketched by a Newspaper Reporter.

If you have never seen Edison as he talks in his factory, you have missed America's most interesting sight, no matter how often you may have been to the Falls or to the Yellowstone.

You would perhaps imagine a man of science who has made millions out of his brain as a democratic personage, but you would never imagine anything one tenth part as democratic as Mr. Edison. Of all the hundreds of mechanics who work for him not one looks less prosperous or less interested in his appearance than does Edison.

You find him in a small room filled with the buzzing of much machinery and of many lamps. Two or three skilled workmen are with him. The light from the blazing bulbs all around is blinding. The air is full of the smell of some offensive acid. Edison is working on a plan to increase from 15 to 20 the lights produced by one horsepower. His success—it is usually safe to assume that he will succeed—will mean a saving of a third in the cost of producing electric light. It is 6 o'clock in the evening. He has been in that room since 7 in the morning, except a half hour for luncheon. He will be there, except for another half hour, until 11 o'clock at night. Just look at him!

His hair is thick, but almost white. It is jet black in patches—black with the blackness of machine oil. His hands are black and dripping. Across his forehead, where he has brushed back the heavy hair, there are four jet-black oily streaks, each marking the passage of a thick finger. His waistcoat is old and greasy. He wears no coat, working Winter and Summer in his shirt sleeves. He wears no cuffs, no necktie, no collar. His shoulders are broad, but he stoops from long work, deep concentration and little sleep. His face has not been shaved for two or three days. But it is pleasant to look at, and it is handsome, with the beauty of great intelligence and of great power. His light blue eyes forever wear a look of searching inquiry. His soul is always hunting for new things, and as much of his mind as deals with men about him is strained to keen attention, for he is very deaf. He is always cheerful. His only idea of pleasure, as most men understand it, is to get a few moments of mental rest. If you ask him what he does to amuse himself, he smiles like a schoolboy and says: "Oh, I just sing, and holler and laugh and raise the devil!" His life has not given him time to learn to have fun, except as he used to have it as a boy. His money gives him nothing except the chance to go on with his work as he wants to.

He has a wonderful head. It looks as big as the head of a bison, and it is covered with bumps. His forehead is high, and it sticks out as though Nature, realizing the work before her child, had at the last minute added a bay window to his brain. If you can manage it, go out and look at Edison, and see what sort of men are working to make this nation great.

Edison has reduced his working hours. He works now only from 7 in the morning until 11 at night For a long time he worked regularly 130 hours a week. That left him 38 hours a week for sleep, a little more than five hours a day. "Plenty," he says, "if a man is well and interested in his work. He can not do as much if the work bores him. Thousands of men play every day as long as I work. It is easy to work if your work is play."

Edison's former method of arranging his working hours was novel and it may safely be told of without danger of universal imitation. His work required great quiet. Therefore he did as much as possible at night, and he tried for as long continuous stretches of work as possible, so as not to interrupt any good train of thought that might come along. He would begin work, for instance, Sunday evening and work steadily until midnight of Monday, a little stretch of 30 hours. Then he would sleep until 8 o'clock Tuesday morning, and work until Tuesday midnight. In this way he managed to clear up a good deal of work in a week.

Young men who feel tired and wonder how it is that they do not become great men really ought to run out and see Edison about once in two weeks. It would do them good and give them some new ideas about causes of success.—*New York World.*

Personal Experience.

Referring to the experiments with tadpoles, mentioned in our issue of Nov. 23, the London *Electrical Review* suggests that a similar experiment might with advantage be tried with a sufficiently powerful current in a public swimming bath. Experiments on the "genus homo" would settle by personal experience whether the down or the up potential gradient was the easier.

Central Station Working—I.

COMBINING STEAM AND WATER-POWER ELECTRIC PLANTS.

BY CECIL P. POOLE.

DOUBTLESS there are many cheap water-powers available for central station purposes, which are not used because of their unreliability or comparatively limited capacity, or because the environments would not admit of profitable extension of the station which the natural increase of patronage would render necessary after a time. Both of these conditions were combined in a single case which came within the writer's experience several years ago. The first-named difficulty was disposed of by putting in a high-speed automatic steam engine, belted to a line shaft, to which were also belted the water-wheel and the dynamos.

Fig. 1 shows clearly the arrangement of the station, which was a small one, containing only two Westinghouse alternators and two Eickemeyer direct-current power generators as its electrical equipment. The water-wheel, under the normal head of water, furnished 65 horse-power, and the engine was a 150-hp Ball. All of the line-shaft pulleys were of the friction clutch type, so that any belt connection might be thrown on or off at off. The station was operated 23½ hours a day except on Sundays, when it was shut down from 8 a. m. until half an hour before dusk to allow the machines to be thoroughly inspected and cleaned. On week days the station was shut down from noon to 12:30 p. m. for inspection. During the day run, when the load was less than the water-wheel capacity, the engine was shut down and the station operated by water alone, the turbine being regulated by hand. Toward night, or as soon as the voltage on the circuits dropped the least bit below the proper point with the turbine running under full gate, the engine was started up and thrown in, care being taken to have an attendant at the switchboard to look out for a slight drop in voltage due to the slightly decreased speed which resulted. The pulleys were so selected that the speed of the line shaft was a shade higher when driven by the water-wheel under full load and with the maximum reliable head of water, than when driven by the engine. Therefore, after the engine was thrown in at night, the water-wheel worked under constant load, all the fluctuations being above its maximum load line; these fluctuations the engine governor took care of. After throwing in the engine clutch the water-wheel gate was left wide open, no regulation there being necessary.

When this plant had been in operation a year or so the motor load became of such a character that the fluctuations on that circuit began to interfere seriously with the regulation when the water-wheel was running alone. An "absorption" regulator was designed by the writer for the purpose of maintaining, by the automatic variation of dead resistance, a steady load on the power circuit (the lamp load did not fluctuate seriously), but at this time a change was made which obviated the necessity for such a regulator. The total load on the plant was becoming too heavy for the water-wheel to handle alone during the day and the night load was getting a little beyond the combined capacity of the water-wheel and the engine. As the station was hemmed in by railroad property on one side and by water on the other three sides, and the soil along the river banks was of such a nature that the proper foundations were unobtainable, a local extension was impracticable. It was decided, therefore, to build another station up in the town a short distance, to which station the steam plant was removed, along with all the electrical apparatus in the water-power station except the two power generators; these were disposed of and two others of much greater capacity substituted. One of the new machines was placed in the old station and belted to the water-wheel, which was just capable of driving it under full load with the usual head of water. The other generator was installed at the new station with the alternators and the old engine and an additional one.

The power circuit was carried in both stations, and the two direct-current machines, one at the water-power station and the other at the steam station, were regularly operated in multiple on the one circuit, as shown diagrammatically in Fig. 2. The result was that when the load on the power circuit was below the capacity of the water-wheel, the direct-current machine at the steam station acted as a motor, receiving what surplus current the power circuit did not require, and helping the engine drive the line shaft, to which all the machinery was belted. The regulation was all done at the steam station, and consisted of simple rheostat manipulation to preserve constant E. M. F. on the line. The only unusual precaution necessary was involved by the shutting down of the station at noon, when it was essential to adjust the rheostat so that the E. M. F. of the dynamo was equal to that of the bus-bars before throwing it out of circuit, so as to avoid suddenly lessening the load on the water-wheel at the other station, which might have resulted disastrously for the motors on the circuit. The proper adjustment was easily obtained by gradually strengthening the field of the dynamo (motor) at the steam station until its ammeter needle pointed to zero, the attendant at the water-power station simultaneously cutting down the water-gate to keep his voltmeter at the proper point. For cutting into circuit the dynamo at the steam station, pilot lights sufficed, as any slight difference of E. M. F. was taken care of by the machine and did not show on the line.

The water-wheel gate at the other station was kept wide open at all times except during the process of closing down, and the field rheostat of the dynamo at the water station was always cut out of circuit, the machine operating under maximum field at all times. The day and night loads on the power circuit lapped, except during mid-summer, so that between 7 and 8 a. m. and 4:30 and 7 p. m. the water-wheel was not able to carry the whole power circuit load and the machine at the steam station came to the rescue, acting as a dynamo, and taking care of all load over and above the capacity of its mate at the water-power station. It occasionally happened during the Winter that a rise in the river cut down the avail-

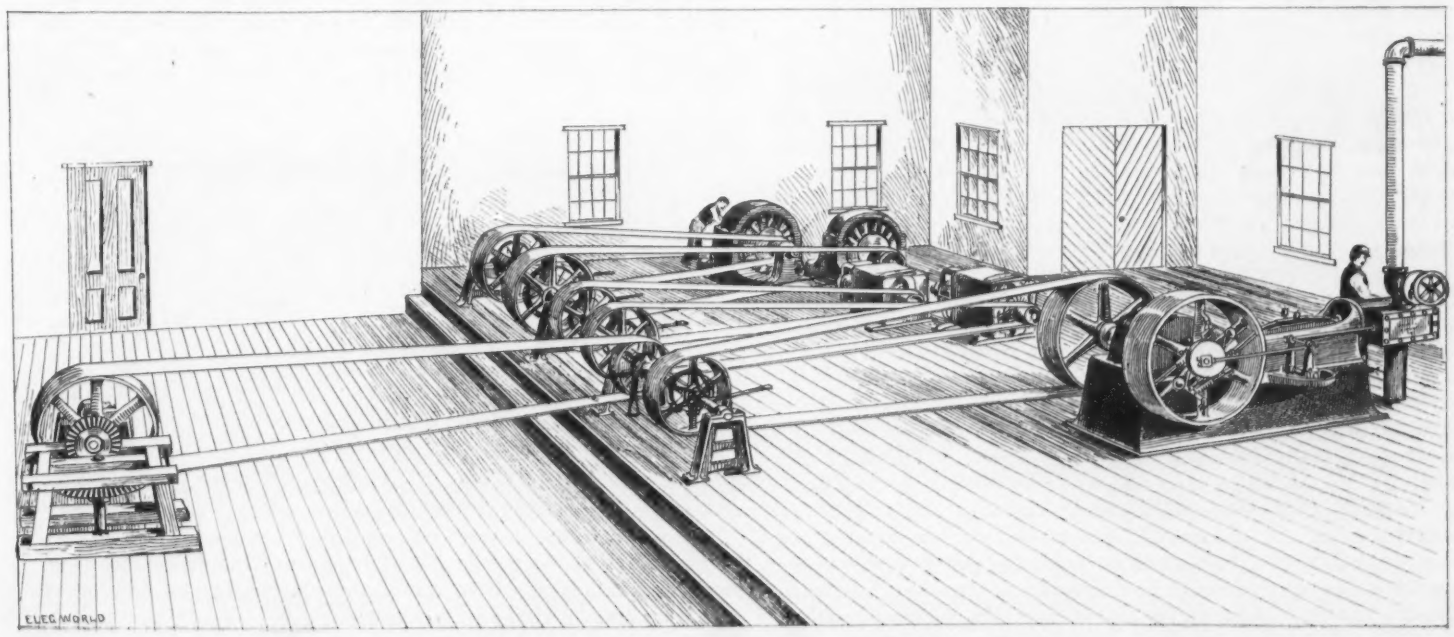


FIG. 1.—COMBINED STEAM AND WATER POWER CENTRAL STATION.

able power at the water-power station, so that the period of overload extended over a larger portion of the 24 hours than between the hours mentioned; at such times also the steam station took care of the overload.

At all other times, however, the dynamo at the steam station ran as a motor, using the surplus capacity of its mate to decrease the work of the engine. This obviously had the effect of working the engine under small loads during the day, but this was cheaper than running at more economical load points by steam alone, with run-of-mine coal at $3 per ton. A much preferable arrangement would have been to provide a smaller engine for day service which would have averaged three-quarters to full load up to the beginning of the peak of the load curve, and then to have substituted a larger engine. The writer did not favor the practice observed in this particular case of working with no reserve apparatus, but the plant, despite its many shortcomings, affords an excellent opportunity to illustrate the feasibility of profitably utilizing cheap, irregular water-power.

The practicability of electrically coupling two stations for the purpose of mutual assistance, without using special circuits or dynamos, was equally well demonstrated in another case. A water-power plant which furnished current only during the night and to arc-light circuits had, after several years' operation, become slightly overloaded, the overload occurring during the first half of the night, when all private consumers' lamps were in use. During the latter part of the night the water-power station was underloaded. The company which owned this station also owned a direct-current incandescent plant, the power station of which was operated by steam, and the problem was to relieve the overload on the arc station during the first half of the night by means of current from the steam station, and to utilize the surplus power of the former at the latter during the balance of the night, putting in the least possible amount of apparatus, so as to minimize expense and complication. In order to effect these results an arc dynamo of 50 lights capacity was installed at the steam station, and belted to one of the engines of the constant-potential dynamos. It was connected in the circuit which supplied private arc light consumers, as shown by the diagram in Fig. 3. A shift of street lamps was made whereby the total overload at the arc station was consolidated on the private consumers' circuit. An automatic regulator was devised for the 50-lighter at the steam station, the function of which was to preserve a constant current on the circuit. This was done during the first part of the night in the ordinary manner, by shunting the field winding of the dynamo at the steam station; towards midnight, when the load decreased on the arc-light circuit to such an extent that the regulator had entirely cut out the auxiliary dynamo, any further decrease caused the regulator to *reverse* the field connections and throw the machine in circuit again to operate as motor, utilizing the surplus power from the water station by helping to drive the dynamo belted to the other pulley of the engine. The wheel gates at the water station were kept wide open from starting-up to shutting-down time, the only regulation necessary there being the equalization of the load between the six 50-light dynamos.

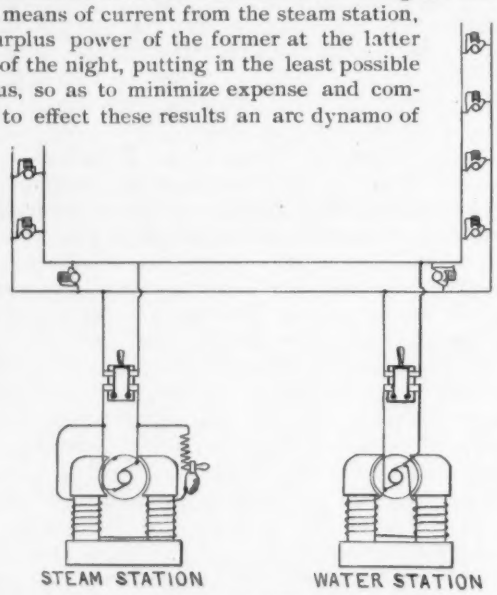


Fig 2.—Diagram of Power Circuit.

Fig. 4 shows the regulator and its connections diagrammatically. A series of contact plates, *C*, was connected in the usual way with resistance coils in shunt with the field winding of the dynamo; a traveling brush, *B*, was attached to a nut, *N*, controlled by the screw, *S*, and electrically connected with one end of the field winding; the large contact plate, *P*, was connected with the other end of the field winding. On one end of the screw-rod were loosely mounted two grooved pulleys continuously driven in opposite directions by belts from the spare end of the dynamo shaft, one belt being crossed, of course. Between the pulleys a sliding collar was placed, which with two pins in the faces of the grooved pulleys, formed a familiar type of clutch. The collar was normally held in a central position by springs not shown in the sketch, leaving the screw free from the influence of the pulleys. An ammeter, *A*, was inserted in the arc circuit, and so adjusted that any drop in current below 6.8 amperes would cause its pointer to touch the left hand contact, completing a local circuit through the magnet, *D*, which threw over the clutch to the pulley which was revolving in the proper direction to draw the brush, *B*, along the contacts so as to increase the amount of resistance in shunt with the dynamo fields. A rise in current produced, of course, the reverse contacts so as to increase the amount of resistance in shunt with the action of the regulator.

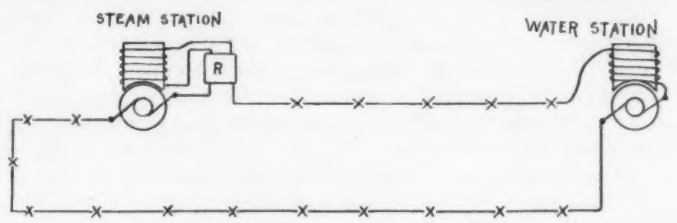


Fig. 3.—Diagram of Arc-Light Circuit.

The most interesting performance of the regulator was its changing the dynamo connections so as to make the machine a motor. The connections were so arranged that with the dynamo acting in its normal capacity, the deflection of the ammeter needle to the right energized the right-hand clutch magnet, *E*, and the screw was revolved in such a direction as to move the nut from left to right, the resistance connections being such that this action decreased the resistance in shunt to the field magnet, as stated above. As the load on the circuit grew lighter and lighter, the nut moved farther and farther to the right, weakening the field, until finally it was short-circuited entirely. Any further decrease in load caused the nut to be carried still further to the right until it moved the ratchet lever and threw the rotary switch, *Sw*, which reversed not only the field connections of the dynamo, but those of the clutch magnets, *D* and *E*, so that the next movement to the *right* of the ammeter needle, due to excessive line current, energized the *left* hand clutch magnet, *D*, and caused the nut to go over toward the left, cutting the reversed dynamo field coils in circuit again with the minimum resistance in shunt relation to them.

With each successive decrease in lamp load the nut was moved to the *left*, strengthening the fields and increasing the counter-electromotive force of the machine, then running as a motor.

The switch, *Sw*, was of the alternately "off and on" type; that is to say each alternate step produced the same arrangement of connections, so that when the dynamo fields were connected normally the next movement of the switch reversed them, the next restored them, and so on. The ratchet lever controlling the switch, *Sw*, upon a retrograde movement of the nut, was drawn back one notch by a spring, not shown in the cut.

When the dynamo was running as a motor and the load on the circuit increased, the nut was carried to the right until it threw the switch again, changing the connections of the field coils and the clutch magnets back to their original position, and the operation

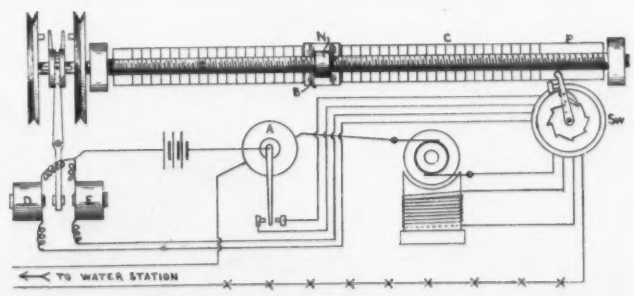


Fig. 4.—Automatic Regulator.

first described was repeated. The current for the clutch magnets was obtained from accumulators.

The only objection to an arrangement of the kind described lies in the fact that the brushes of the dynamo require tolerably close attention, particularly when the machine is running on light field excitation and changes over to a motor.

The Lawrence Accumulator Station.

ALTHOUGH by no means as extensive as the storage battery installation in the Edison station at Boston, the accumulator plant of the Lawrence, Mass., Edison Illuminating Company will attract much favorable attention, from the very fact of its comparatively diminutive size, for it plainly shows that small storage-battery systems may be installed in connection with electric lighting plants with beneficial results. The Lawrence Company having felt the need of additional capacity, installed a plant of 140 cells, 72 on either side of the neutral of its three-wire system. The battery had unequally a capacity of 100 ampere-hours, but the cells were large enough to admit of doubling the number of plates, and very recently this contemplated addition has been made, making the present capacity of the plant 200 ampere-hours.

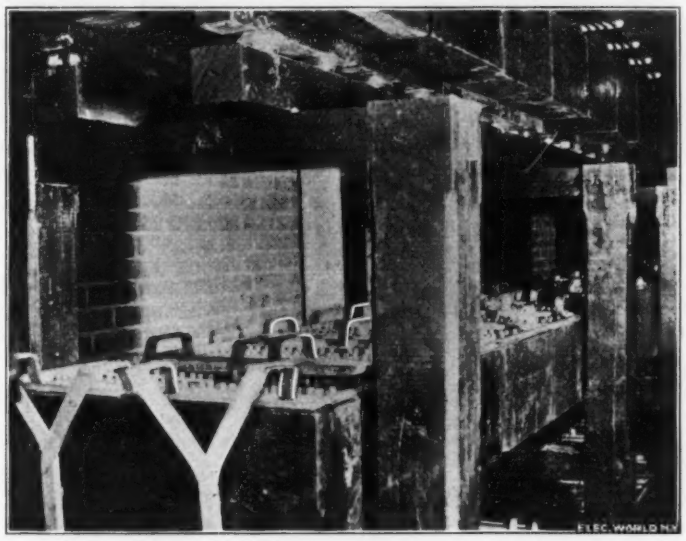


FIG. 1.—ACCUMULATORS.

The batteries are of a combination type, chloride accumulator negative plates being used with the Tudor positive plates. The fact that the Lawrence Company has seen fit to duplicate its storage battery outfit is substantial proof of the success of the cell. The cells are installed in a small room in a thoroughly substantial, though by no means elaborate, manner. Strong uprights are placed along the floor at intervals and horizontal beams going from the uprights to the adjacent wall form the supports for the platform on which the cells are placed. The room is long and narrow and two such tiers of cells are placed one against each wall. This leaves an aisle between by means of which ready access may be had to all the cells. Fig. 1 shows the cells and a portion of the construction of the supporting platforms.

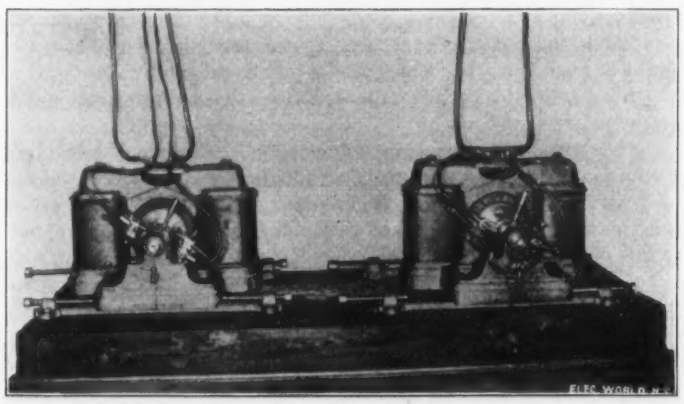


FIG. 2.—BOOSTERS.

The cells, as they have a voltage on discharge equal to that of the dynamos themselves, cannot be readily charged therefrom, and therefore a booster system is connected in series with the charging dynamos. Fig. 2 shows the boosters, which are of the consequent pole type. The charging current is 80 amperes.

The method of connecting is shown in Fig. 3, and, as will be seen, the batteries are in circuit all the time, and are always charging or discharging. The sliding switch is a multi-pointed radial switch, and is operated by hand. It may be seen on the switchboard in Fig. 4. Ammeters are provided in the battery circuits, and measure the input and output, as the case may be. Voltmeter switches are provided, and by their means the voltage of either division of cells, the booster, or main dynamo, can be obtained at pleasure.

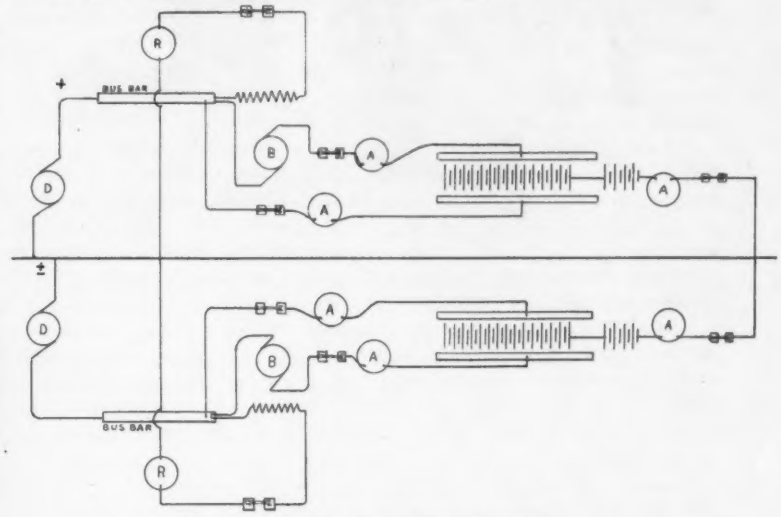


FIG. 3.—DIAGRAM OF CONNECTIONS.

The system is intended to help the plant over the peak of the load from 4 to 6 p. m. and to give the engines and dynamos an economical day load. As far as it has been used it is entirely satisfactory.

Changes in Underwriters' Rules.

A Western correspondent writes us that since receiving the issue of THE ELECTRICAL WORLD of Dec. 21 giving an account of the recent changes made in underwriters' rules, he has made a tour of the leading electrical concerns in Detroit, Mich., and finds that the proposed change regarding fixture cut-outs meets with almost universal approval. Some of the older electrical men have never favored cut-outs in fixture canopies, and the opposition to that kind of construction has been growing in Detroit for a long time. A firm who are engineers for the wiring plant to be installed in the Detroit High School Building, in their specifications for that work prohibit the use of cut-outs in fixture canopies. This change, he adds, will necessitate greater care in the matter of fixture wiring, but the use of small

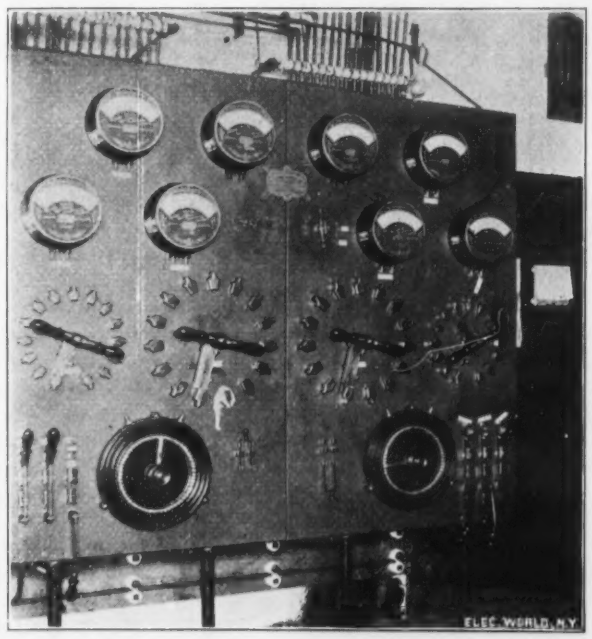


FIG. 4.—THE SWITCHBOARD.

conductors and light installation in fixtures should not be allowed under any circumstances. A suitable coupling for connecting fixtures without soldering would prove a great convenience, and, with the approval of the Underwriters' Association, would prove profitable to the manufacturer.

Electrical Matters at Niagara Falls.

BY ORRIN E. DUNLAP.

IF we are to judge from the number of the new concerns seeking sites for plants at Niagara Falls, the cheap electrical power available there is furnishing an incentive to manufacture some things never before produced in the United States.

The Niagara Electro-Chemical Company has been organized to manufacture sodium and peroxide of sodium on the tunnel lands. The building to be erected will be 100 by 130 feet, and 800 horse-power will be used at first, to be increased to 1600.

The Chemical Construction Company, of New York, has let the contract for its new plant, to be located on the Niagara Falls Power Company's lands. The buildings will be two in number, two stories high, one 125 by 60 feet, the other 30 by 60. They are to be completed in March next. Five hundred horse-power will be used by this company.

Good progress is being made with the new calcic carbide plant. The building is of brick, 40 by 90 feet, the front portion being two stories high. The product of this factory will be sent to Southern Pennsylvania, and other plants of the same nature to be erected here will supply other localities. The present factory expects to be in operation by Feb. 1. Its output will be shipped in loose form in barrels to Philadelphia, where it will be liquefied and tanked for use as acetylene gas. The men connected with this company express themselves as confident that they are going to accomplish wonderful things with this new gas. The factory now building here is the first one in America, outside of the crude parent plant in North Carolina. There has been much said in various publications about the poisonous qualities of acetylene, but, in talking with President Kent recently, he stated that he had it upon the highest authority in the United States that the poisonous qualities of acetylene are as 1 to 50 compared to coal gas.

The carborundun plant is a sceneo f activity both on the interior and the exterior. Outside, two large new kilns have just been completed and the building to cover them is going up. Inside, the necessary presses and machinery for manufacturing the various articles to be made are being installed. This company is receiving about 400 amperes and their bases or furnaces are so arranged that they use one each day. Each furnace produces about 3500 pounds of carborundum.

The 500-hp rotary transformer installed by the Westinghouse Electric & Manufacturing Company in the Niagara Falls Power Company's station about six weeks ago is giving good satisfaction. It is used in connection with the power supply to the Buffalo-Falls road and it is to be duplicated. The reduction in voltage from 2000 to 400 is accomplished by means of a step-down transformer located beneath the floor of the building and below the rotary transformer. The alternating current of 400 volts is taken into the latter and transformed to a direct current with a voltage of about 600.

The new power-house of the Cliff Paper Company on the debris slope of the high bank of the lower river is well under way. In this power-house will be placed a 250-hp turbine, to which will be attached two 125-hp generators, which will furnish power for two motors to be located in the paper mill on the top of the high bank. When this new electric plant is in operation it will take the place of three steam engines of over 200 horse-power. Then the Cliff Paper Company will be the first users of electricity for paper-making. The change will be made about February. A. C. Hastings is manager.

The foundation walls of the new plant of the Pittsburg Reduction Company, on the lands of the Hydraulic Power & Manufacturing Company, have been started. The building to be erected will be of corrugated iron about the size of the present main building on the lands of the Niagara Falls Power Company. The Pittsburg Reduction Company's contract with the Hydraulic Company calls for 4500 horse-power, which will be about the same amount it will receive from the Niagara Falls Power Company, with the enlarged plant it contemplates. The Westinghouse Electric & Manufacturing Company has secured the contract for the electrical equipment of the new plant on the hydraulic canal basin, while the General Electric Company will do the work necessary in doubling the plant now in operation. This increase of capacity will be effected by raising each of the four rotary converters from 400 to 600 kilowatts capacity by rebuilding them, and the installation of an additional rotary converter of 600 kilowatts. The static transformers will be likewise increased and added to. This will give a total of 3000 kilowatts as compared with the 1600 now in use, or nearly double the present capacity. At present the Pittsburg Reduction Company is receiving 300 amperes on each of two phases at about 2200 voltage.

The amount of its product is kept a secret, but enough is shown to give assurance that the company is very successful in the use of Niagara power, as the proposed enlargement and new plant indicate. With its enlarged and its new plant in operation, it is expected that 10,000 pounds of aluminum a day will be turned out, or a total of 3,366,000 pounds during the coming year. In 1894 the output of aluminum in the United States was 550,000 pounds, and this year it will reach 850,000 pounds. Capt. Alfred E. Hunt, president of the Pittsburg Reduction Company, states that when the new plant on the lower river bank is completed the current will be carried from the power-house in the gorge to the pots in the factory on top of the bank by aluminum instead of copper conductors.

The Niagara Falls Hydraulic Power & Manufacturing Company is now building its new power-house at the water's edge in the gorge. This company owns the hydraulic canal that extends through the southwest portion of the city from the upper to the lower river. The power-house will be of stone, 60 feet long by 100 wide. In order to get a substantial foundation for this structure it was necessary to clear away the debris slope until solid rock was reached. On the first floor of this power-house four turbine wheels of the horizontal type will be placed of a total capacity of about 7000 horse-power. One novel feature that will attract attention as to their operation will be the fact that a head of 210 feet will be used, the highest at Niagara, if not in other places, considering the amount of power to be developed.

The turbines will be mounted on horizontal shafts of the double-discharge design and fitted with runners 74 inches in diameter, made of bronze metal and fitted with balanced gates. They will be so designed that the wheel runners will be absolutely balanced, due to the equal discharge of water on each side, thus doing away with all end-thrusts on the shafts. They will be fitted in cases 11 feet in diameter, made of best heavy plate steel, double riveted. The feeder-pipe connection will be at the bottom of the cases and riveted directly to the five-foot hydraulic cylinder valves. All these valves will be connected to the main feeder pipe, which is 10 feet in diameter, and occupy the space under the turbines between the foundation walls. The draft tubes from the turbines will pass down each side of the main feeder pipe connecting with the tail water, which will be set at a distance of 27 feet from the centre of the turbine shaft. The shafts will be of hammered wrought iron, and carried in adjustable ring oiling bearings, mounted on heavy cast-iron bridge-trees.

Water to feed the penstocks will be drawn from the hydraulic canal basin through a channel walled with solid masonry to a forebay, which will be 30 feet wide and 22 feet deep. The penstocks will be of flange steel, eight feet in diameter, increasing in size to 10 feet after they enter the power-house. The basin of the hydraulic canal from which the water will be taken to run the turbines is about 300 feet back from the edge of the bank of the river, and the supply will run through the channel to the forebay. The power-house will be ready for use next Spring.

The report that the Canadian Niagara Power Company would break ground for its power-station on the Canadian side in Queen Victoria Park within four months is incorrect. It has entered into an arrangement with the Niagara Falls Park & River Railway Company, owners of the trolley line along the high bank on the Canadian side of the river, allowing the railway to sell surplus power to customers until such time as the Power Company shall have its product ready for distribution. This agreement was made necessary because the Canadian Niagara Power Company holds the exclusive privilege and right to generate power for industrial purposes in Victoria Park. Some idea of the time when this great Canadian power-plant will be commenced and finished may be gained from section No. 10 of the article of agreement with the commissioners of Queen Victoria Park, which provides that the company must begin the work on or before the first of May, 1897; and have proceeded so far on or before the first of November, 1898, that it will have completed

water connections for the development of 25,000 horse-power, and have actually ready for use, supply and transmission 10,000 developed horse-power by the last mentioned day.

The route of the Niagara Falls & Lewiston Railway is close to the water's edge through the Niagara gorge. At present the electric power supply is furnished by the Niagara Falls Hydraulic Power & Manufacturing Company, but the owners of the railway would appreciate a device that would develop enough force from the river's current to operate the road, and, if possible, leave a surplus to sell at points along the line. From the Buttery elevator to Lewiston, the course of the road is along the fiercest current in the river, and there is hope that a current motor will be invented that will do good service. The current runs from 8 to 30 miles an hour, and already there have been motor tests. One was by Eugene Ruhlmann, of Lockport, N. Y.

The Ruhlmann wheel is a spiral screw 4 feet in diameter and 5 feet 9 inches long, made of No. 16 inch iron, and has a cold-rolled steel shaft 1½ inches in diameter, which is in turn surrounded by a wooden core 1 foot in diameter. Preparatory to the test a wooden turn-table was erected on the rocky shore at the water's edge, and from this "the tower," of cantilever pattern, built of steel 40 feet long, 5 feet square at the centre and tapering to 5 inches at either end, projected for half its length over the water. The wheel was attached to this "tower" by an "E" and fastened to the two ends of the figure. This pattern of projection was adopted in order that the wheel might be regulated or stopped at will. Some years ago the judges at the International Fair in Buffalo awarded Mr. Ruhlmann a certificate of merit for his wheel. Since the test Ruhlmann's plant has been carried down and across the river by high water. The wheel developed a small amount of power. Within a short time it is expected that a test of a current wheel owned by M. P. Thatcher, the United States Consul at Windsor, Ont., will occur in the rapids near the Buttery elevator.

Mr. L. W. Hotchkiss, of Lewiston, is the latest in the field with a project to secure electrical force from the current of the lower river. He would throw a bridge across the river at the outlet of the whirlpool and use it to support a shaft bearing one or more wheels of suitable pattern. At each end of the bridge and shaft he would locate a power-house, thus being able to supply, according to his ideas, both the Canadian and local market with power.

The energy generated by the big dynamos of the Niagara Falls Power Company is beginning to occupy its field most successfully. The surface of the Buffalo-Niagara Falls Road is all that could be desired. There was an interruption of a few days recently, but the trouble, which was purely mechanical, has been remedied. Besides this the entire line of the Niagara Falls & Suspension Bridge Railway is now enjoying a power-service from the big power-house. The Buffalo-Falls road uses on the average about 350 horse-power from the big dynamos, but this amount will be increased during the heavy excursion travel of Summer-time. The Niagara Falls & Suspension Bridge Railway use 200 horse-power.

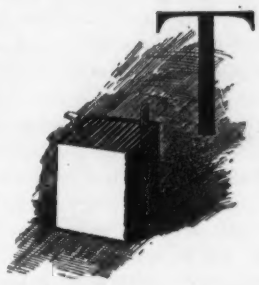
Should the New York Central's Falls-Lewiston branch be operated by electricity next season no one need be surprised. The road could be equipped for electricity within a very short time.

A searchlight trip, so enjoyable among the Thousand Islands on the St. Lawrence, is not an improbable attraction for the Falls next Summer. The owners of the *Maid of the Mist* have already thought of this feature of a Summer night at Niagara, and next year the trip may be made before the Falls by electric light.

Electricity, the greatest modern revolutionizing force, is about to bring about another great change in Niagara Falls, having created a demand for increased facilities which have resulted in the Niagara Falls and Clifton Suspension Bridge companies taking steps to erect a fine, large new steel arch bridge across the gorge to replace their present suspension bridge. This latter bridge was built in 1889, and was so constructed as to create the impression that it would last almost forever. Then, however, the uses of electricity were not so widely known as now, and the trolley-line development not so great. Since then trolley-road construction at Niagara has been very active, and there is a demand for a bridge to allow of an international trip around the gorge. To meet this demand the bridge companies referred to will build a steel arch. The width of this structure will be 49 feet, 23 feet of which will be devoted to a double-track trolley line, on each side of which there will be a carriage way eight feet wide, and beyond these elevated walks for pedestrians, each nearly four feet in width. The abutments of the proposed structure are now being built, and the superstructure, it is expected, will be erected next Spring.

Notes on Accumulator Testing—I.

BY CARL HERING.



TO some, it may seem, at first sight, to be a very simple matter to test accumulators, but a little experience will show that this is not the case, at least when it desired to find their true worth. There are a number of important factors entering into such tests which are entirely different from those in all other electrical testing, and it by no means follows that any one, who is an expert in the usual electrical testing, can make an intelligent test of an accumulator, unless he has had experience in that particular line, or has made a special study of the subject. The importance of some of these factors may be shown by the fact that any one "expert in the art" could so prepare a good accumulator for a test that it will appear to have an efficiency of over 100 per cent., if calculated from the figures obtained in the test. Although such a result would of course be considered erroneous by any intelligent person, yet the same method may also be applied to make it appear to have an efficiency very little below 100 per cent., which might be accepted as correct while really it is quite wrong. It therefore follows that an intelligent accumulator test involves not only a mere set of readings of an ampere-meter, a voltmeter and a watch, but it also requires a knowledge of the properties of such batteries which will enable one to be sure that the results are real and not only apparent; and in the case of a comparison of two types it is very necessary to know whether the comparison is true, fair and just to both cells. This does not mean that the tests themselves are difficult to make after they are started, as this is very easy, and may be done by any one capable of taking readings and of attending to his duties; nor does it mean that there are any great difficulties involved in laying out and starting a test; but what was intended to be pointed out here is that the *conditions* under which a test is made are of very great importance, and must be well understood in order that the results are to be reliable. The object of the present article is to point out some of the more important of these conditions, and to give a few hints regarding the carrying out of such tests.

In general there are two kinds of accumulator tests. In the first kind the object is merely to determine in behalf of a purchaser whether an accumulator will do what is claimed by the maker in the contract of the sale. This is a comparatively simple matter, as the conditions of the test are, or should be, all determined by the maker, and the person making the test has merely to see that it is carried out under these conditions. This is, therefore, only a special case of the second kind, and need not be considered separately; the suggestions given below for the more difficult test should be followed as far as they do not conflict with the conditions determined by the maker. But if the latter differ materially from those under which the purchaser intends to use the cells, it is the imperative duty of the one making the test to call attention to it, to point out the differences, and to explain, if possible, how it would probably affect the results. It is generally much better to have the conditions the same as those under which the purchaser intends to use the batteries so as not to necessitate explanations or allowances; but the conditions need not necessarily be identical, as it would not be necessary for instance to test a whole series of 60 cells simply because that number are to be used, a few sample cells, provided they are fair samples, will do just as well; nor is it necessary to test a traction battery on the car itself in order to find the output per weight, although this might be advisable if there is any question about whether the plates will stand the mechanical strains to which they would be subjected.

The second kind of a test is that made by the maker himself to find out what his battery will do, how it will do it, and what its best conditions of working are. Tests made by a consulting engineer, in behalf of a prospective investor in a storage battery, to find its true worth, belong to this same class. In these, most, if not all, of the conditions under which the tests are made must be determined by the one conducting the test, and it is therefore very important for him to understand the peculiar behavior of a storage battery, and the important requirements of a good cell, in order to properly plan his tests. This is all the more important when two batteries of different makers are to be compared with each other; it would be quite possible, for instance, for one "skilled in the art" to make one accumulator appear to be better than another, while really it is

inferior, even though the comparison is based on the actual results obtained from a test. Many investors and inventors have been badly deceived or have deceived themselves in this way.

The first point to be decided is what general purpose the accumulator is intended for; that is, whether for stationary or for portable purposes. If for the former, then its weight is of comparatively little importance, except perhaps that if relatively heavy it may be more expensive to construct, owing to the larger amount of materials required; the lead in a battery forms no small part of the cost of the materials. The floor space, accessibility for inspection, and other features to be mentioned below, are perhaps of more importance than the weight. Nevertheless the weight ought to be measured and noted in a well-conducted test. If, on the other hand, the battery is intended for portable purposes, the weight becomes one of the most important factors, and should be taken with all the accessories, including one coupler, if these are used. The mere weight of the plates alone, which is so often quoted, is of interest to the constructor, but of no importance to the user, as they cannot be used without the acid, jar and coupling, which therefore should be included; it is no consolation to the user who has to carry the weight, or provide for carrying it, to know that a great part of the weight is due to other things than the plates, but equally essential to the operation of the battery.

A most important matter to be decided at the outset is the *rate* at which the battery is to be charged and discharged. This also will depend on what the battery is intended to be used for. All lead accumulators have the property that the faster they are discharged, the smaller will be the capacity, and it is for this reason that the rate of discharge is so important. Accumulators in which the active material is in comparatively thick masses, or those in which the acid has not very free access to every particle of the active material, or both, the capacity will fall quite rapidly as the rate of discharge becomes greater, while if the active material is very thin and freely exposed to the acid, the capacity will be less dependent on the rate; in the ideal battery the ampere-hour capacity would be independent of the rate and the watt-hour capacity nearly so. As a rule, a cell for slow, long discharges at low rates is easier to construct and is cheaper than one for quick discharges, the useful capacities being the same. If constructed for slow discharges, they are usually unfit, or nearly so, for rapid discharges because their capacity becomes too small, but those for rapid discharges can be used for slow rates, although they may not hold the charge quite as well for long periods of rest. Theoretically, the rate of discharge depends on the surface exposed to the acid, and the capacity on the amount of active material. In extremely porous plates the effective surface is an unknown and indeterminate quantity.

In many, if not a majority, of the cases in which a storage battery would be a valuable adjunct to an installation, it is the *rate* of discharges rather than the capacity which governs the size of the battery to be used, at least with the usual type of accumulators. In other words, it is more often that a great horse-power is required for a comparatively short time, from a few minutes, to, say, three or four hours, than a small one for a long time; in the former case all that remains in the battery after that short time is of little or no value (except if the discharge is intermittent), and it is therefore the allowable rate of discharge and not the capacity which governs the size of the cell required.

Special attention is here called to this question of the rate of discharge, because it seems to be a point about which there is much confusion, and the importance of it is not generally recognized. For instance, statements are made that the cost of a battery per horse-power is less than that of direct generating machinery, but on examination it will be found that this price depends very greatly on the rate, and is not a fixed quantity for the usual types of accumulators.

Unfortunately there is no uniformity in stating rates. In Europe rates are generally given in amperes per pound or kilogram of plates or of the complete cell. This is a very unsatisfactory method, for numerous reasons. Another way, not frequently used, is to give the rate as a fraction of the capacity, thus, a rate of one tenth means that one tenth is taken out during each hour; this is much more rational, but is not self-explanatory. To give the rate in amperes alone carries no meaning whatsoever with it, unless combined in some way with the size, capacity, weight, or other figure defining the cell. The most rational way to define the rate is to give it in *hours* or for rapid rates in minutes, which simply means that with a certain current, depending on the size of cell, the battery will run that many hours before it is discharged. This is the method adopted by the leading storage-battery company in this country, and it is to be highly recommended. Thus, it would be stated that the capacity of a battery is so and so much at a 10-hour rate, or at a 4-hour rate, etc., meaning that the current is such that the battery will be exhausted in that time. The only objection to this system is that a *higher* rate is represented by a *smaller* number. The terms *slow*, *normal* and *excessive*, used by a large well-known company, and signifying a 24, a 10 and a 4 hour rate respectively, are not to be recommended for general use, as what is "normal" for one kind of battery may be very slow for another; furthermore, rates of discharge of less than four hours are of great importance, but the superlative term "excessive" infers a sort of limit, which, though it may apply to some types, does not necessarily apply to others.

(To be continued.)

Edison's Plans for War.

In the New York *World* of Dec. 29 Mr. T. A. Edison outlines at some length the plans he has in view for coast defense in case war should be declared with England. One of these consists in running out cables, the extreme end being about 15 miles from the shore. These cables would run on wheels placed at the bottom of the ocean, and to them at intervals would be attached torpedoes of great destructive power. It is proposed to move the cables back and forth from a subterranean workshop, and thus shift the torpedoes under the waves as the ships move. Mr. Edison thinks that the topography of the New York coast makes it easy to so plan a series of these subterranean cables that the English ships would be compelled to pass over one or more of our "submarine necklaces." When a ship has been located over a cable by means of a range finder, a button would be pressed, a torpedo released, and automatically explode when it struck the ship. He believes that a belt of these cables, crawling like snakes along the bottom of the ocean awaiting for invading ships, would make the country secure.

Mr. Edison said that he rather liked his idea of flying torpedoes, and thinks that they would prove to be great pacifiers. But unfortunately, he added, the English ships could bring them over to this country and use them to drop over our cities, whereas it would be difficult for us to control them accurately enough to direct a charge over a ship. He thinks, however, that if we had them first we could send a few over on our fast cruisers and drop them over London or Windsor and thus end the war.

He referred to his plans of fighting by means of electrified currents of water, and stated that with 25 men he could thus make any fort absolutely impregnable as far as assault was concerned. This, he added, is not guess work, but a matter of absolute certainty, and he believes 25 men would be a very liberal garrison to annihilate 10,000 of the enemy. In each fort he would put alternating-current machines of 20,000 volts pressure, one wire of which would be grounded. A man could govern by hand a stream of water of 400 pounds pressure to the square inch, with which the other wire would be connected. Mr. Edison says that a man could run the water back and forth, playing on the enemy as they advanced, and throwing them down with absolute certainty. Every man touched by the water would complete the circuit, get the full force of the current, and never know what happened to him. In trying to take a fort by assault, though the attacking party should number tens of thousands against a handful, he could thus protect it without much effort. He says that it would not be necessary to deal out absolute death unless the operator felt like it. He could modify the current gently so as to stun everybody; he could then walk outside the fort, pick up the stunned generals and others worth keeping for ransom or exchange, and make prisoners of the others, or, if inconvenient, play the hose on them once more and "send them to the happy hunting grounds for good." Mr. Edison says that when he first announced this plan it was severely criticised, but he thinks that no man could be sufficiently insulated from the 20,000-volt current to protect him from its deadly effects.

He Must Have Been a Bachelor.

According to a French journal an inventor has devised an electric arrangement which consists of a microphone placed near the head of a baby in its cradle, and connected to a sort of relay which operates an electric bell placed near to where the nurse is asleep; a cry from the child will therefore cause the bell to ring.

Accumulator Traction.

The mention of battery cars, says the London *Electrician*, has a tendency to make an electrical engineer's mouth water, but hitherto they have done little else than make his eyes weep.

Electricity in the Capitol at Washington.

BY GEORGE H. DRAPER.

WITH the opening of the present session of Congress a new electrical plant for the Capitol at Washington was put in operation, thus finally providing for the adequate lighting of the building after some years of effort to obtain the necessary appropriation for that purpose.

Originally, there was installed a small trial alternating plant in the Senate wing of the Capitol building, and later one in the House wing. At first only a small number of lamps were placed in the most prominent committee rooms, but electric lighting soon began to grow in favor among Senators and Representatives, and within a short time the demand for this mode of illumination was so great as to necessitate overloading the small machines installed, making it a very dangerous experiment. At the last session of Congress, however, an appropriation was made for a new electric lighting system for the Capitol, with a plant of sufficient capacity in both wings. Two Westinghouse engines of 140 horse-power each have been placed on each side, down in the subterranean vaults, each direct-connected with a 75-kw direct current 125-volt generator, with a total capacity of 6000 lamps of 16 candle-power each. The engines of either wing are capable of rendering full service for the whole building, and they are so arranged that they can be used interchangeably in case of accident or derangement of part of the plant.

An attractive feature of the new system will be a set of powerful electric signals on the summit of the great white dome. Heretofore when either house has been in session at night that fact has been indicated by a lamp displayed from the dome, visible at a distance. But nobody could ever tell from it whether the House or the Senate alone or both houses were in session. The new signals provide for a red electric light to denote that the House is in session, and a blue light for the Senate, while both red and blue, with white thrown in for color effect, will announce that both houses are sitting simultaneously.

On the House side there are installed two Babcock & Wilcox latest improved steel boilers, with nickel finish, especially made for the electric plant. On the Senate side two boilers of the same make, placed there some time ago in connection with the heating and ventilating department, have been turned over for the use of the plant at that end.

The wiring on the Senate wing has all been removed or overhauled and new wire put in its place. The switchboards are of white marble, of an extra finish and with nickel trimmings, all connections being made on the back, and are models of neatness and design.

Electricity is not only used for incandescent lighting at the Capitol, but is utilized in many ways. Both Congressional halls have always been lighted by gas, there being over 1000 burners over the Senate Chamber and more than twice that number over the Hall of Representatives. They were lighted by an electric gas lighting system which necessitated turning on the flow of gas for some time before the jets are ignited, thus causing the chambers to become filled with a disagreeable smell, which had been a source of much complaint. Before the present series arc lamps has been perfected some were placed over the Senate Chamber for the purpose of demonstrating their availability, but the flickering of these lamps caused so much annoyance that they were soon ordered out. Welsbach burners were also tried with but little success, and now it is contemplated using the so-called incandescent arc lamp.

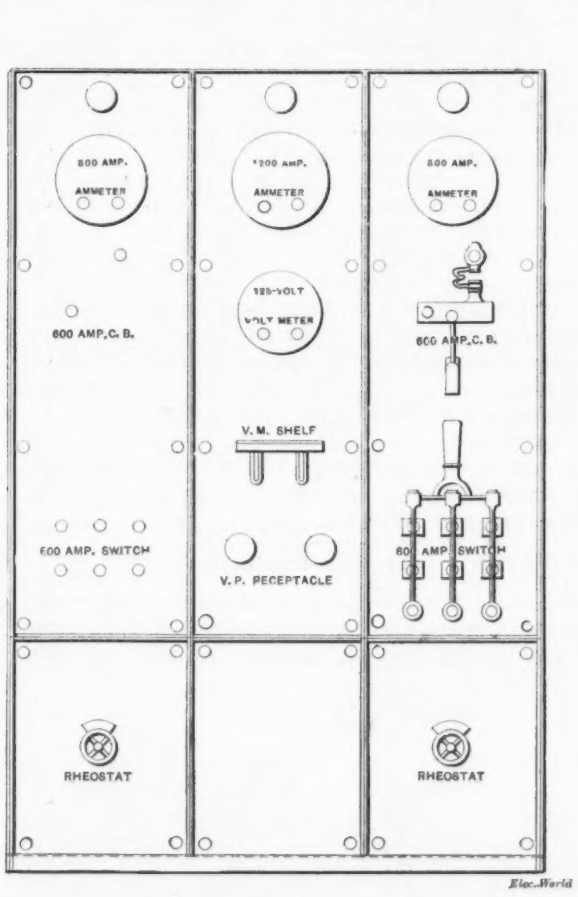


FIG. 1.—FACE OF SWITCHBOARD.

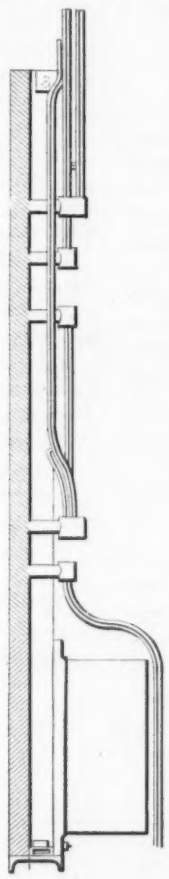


FIG. 2.

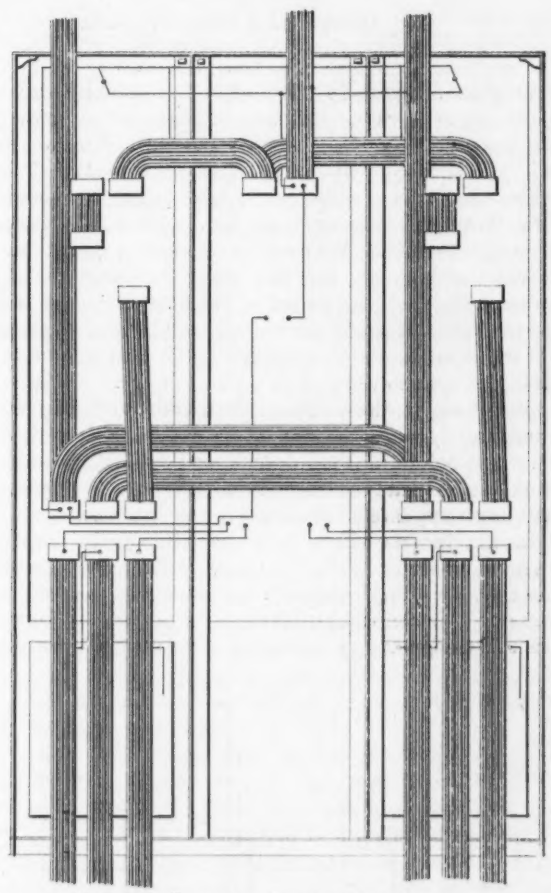


FIG. 3.—BACK OF SWITCHBOARD.

Another innovation in the House will be made in the method of summoning page boys to the desks of Representatives. Hitherto, and ever since Congress has been in existence, the members have called up the pages by lightly clapping their hands together—a method open to criticism, and often the cause of much inconvenience. When a considerable number of members clapped their hands at the same time the ordinary confusion of the House Chamber was increased tenfold, and oftentimes an eloquent orator on the floor could not make himself heard above the din. All these annoyances will now be obviated. Electric wires have been strung from each member's desk to an indicator and callboard in the cloak-rooms similar to those in hotel offices, and each desk will be supplied with a push botton, so that all a member or Senator will have to do when he wants a page will be to press the button and the page will appear.

A similar plan has been proposed, though it may not be adopted, to facilitate voting and eliminate the long and tedious oral yea-and-nay roll call. This plan contemplates running electric wires from the members' desks to a large indicator located in front of the

Speaker's table, where it can be seen readily, so that when the yeas and nays are ordered a vote may be taken all at once by means of pressing the buttons. In this way members can show whether they are paired and whether their vote is yea or nay, all in a few seconds. whereas it now takes from 30 to 45 minutes to finish a roll call. If the new electric system for summoning the pages works well it will be the forerunner of further uses of electricity in the conduct of both houses.

Another invaluable innovation will be a separate and special telephone directly connecting the House and Senate for speed and certainty of communication between the two bodies. Heretofore the only telephonic communication available was had through the central exchange in the city.

An improvement still more useful will be provided in the shape of a continuous bulletin of proceedings in both houses, to be displayed in the lobbies, giving a brief outline of the proceedings at frequent intervals, like telegraphic bulletins from national political conventions.

A perfect running chronometer will also be established in the private lobby of the House, electrically connected direct with the National Observatory, so that the Speaker will have the exact time, and convene the House on each day's session exactly on time.

Design of a One-Kw Motor.

BY ALTON D. ADAMS.

The great advance in the design of electrical machinery and its adaptation to users' requirements during the past few years is perhaps nowhere more marked than in small dynamos and motors of from ½ to 10-kw capacity. The importance of improvements in these machines to sellers and users of electric power is emphasized by the fact that a very large per cent. of the total horse-power of electric motors operating in cities is included in these sizes.

Time was not very far back when the purchaser of a one or two hp motor might expect to get a machine operating anywhere from 2000 to 4000 revolutions per minute, and having its armature covered with wires so fragile that contact by its own weight with any rough surface was apt to work them serious injury. These conditions are happily changed; there are on the market to-day a number of small motors and dynamos of high efficiency, made to operate at speeds of about 1500 revolutions per minute and slower, to meet the requirements of users, and having the fine armature wire essential in these small machines safely embedded in the iron core.

The aim in this article is to give the main data for a one-kw dynamo and motor at 1500 revolutions per minute, which shall illustrate the above improvements and compare favorably in first cost, efficiency and operating qualities with present high-grade machines.

In this design the U type with armature at the top is selected, and the magnet frame is made up of two iron forgings, each forming a core and pole-piece in one, and a cast-iron yoke, which also forms the base. An opening, 2 inches wide and 8½ inches long, is cored and machined out through each side of the cast iron base, and in these openings the core and pole-piece forgings are secured by one long bolt on each side. This connection between forgings and cast base insures a solid contact having three to four times the area of the forging, and is cheaply carried out.

An armature core of the drum type is used, and is slotted to receive the winding for its better protection, and because a greater length of air-gap between armature core and face of pole-pieces than is necessary for sparkless operation will be required if a smooth core is used. This armature core is 6½ inches in diameter, and is made up of soft iron discs to the thickness of 2 inches, with a ¼ inch hard fibre disc and a bronze flange at each end. There are 32 slots, each ⅛ inch wide and ½ inch deep, equally spaced about the core, and each slot is insulated with a mica trough .04 inches thick.

For motor work at 110 volts the armature is wound with 32 coils of 14 turns each, of No. 17 B. & S. magnet wire, and the coils are

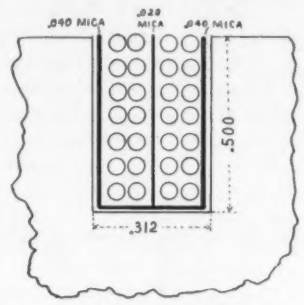


Fig. 2.—Armature Slot.

arranged two in each slot, side by side, with a strip of mica .02 inches thick between them, as indicated in the sketch.

The shunt field coils for 110-volt motor work require 10 pounds of No. 24 B. & S. magnet wire, wound on in even layers, one half on each spool. At full load the losses in above windings are, in field about 55 watts, in armature about 40 watts, or a total of 95 watts.

Hammered and machined forgings for this machine can be had at a moderate price, and the slots in armature core can be milled out when a die is not to be had, for less than the saving effected in field winding by their use.

It is well to bore out the armature cavity and pedestal seats at one operation, as this brings them into line, and the pedestal can then be turned to the proper radius for mounting.

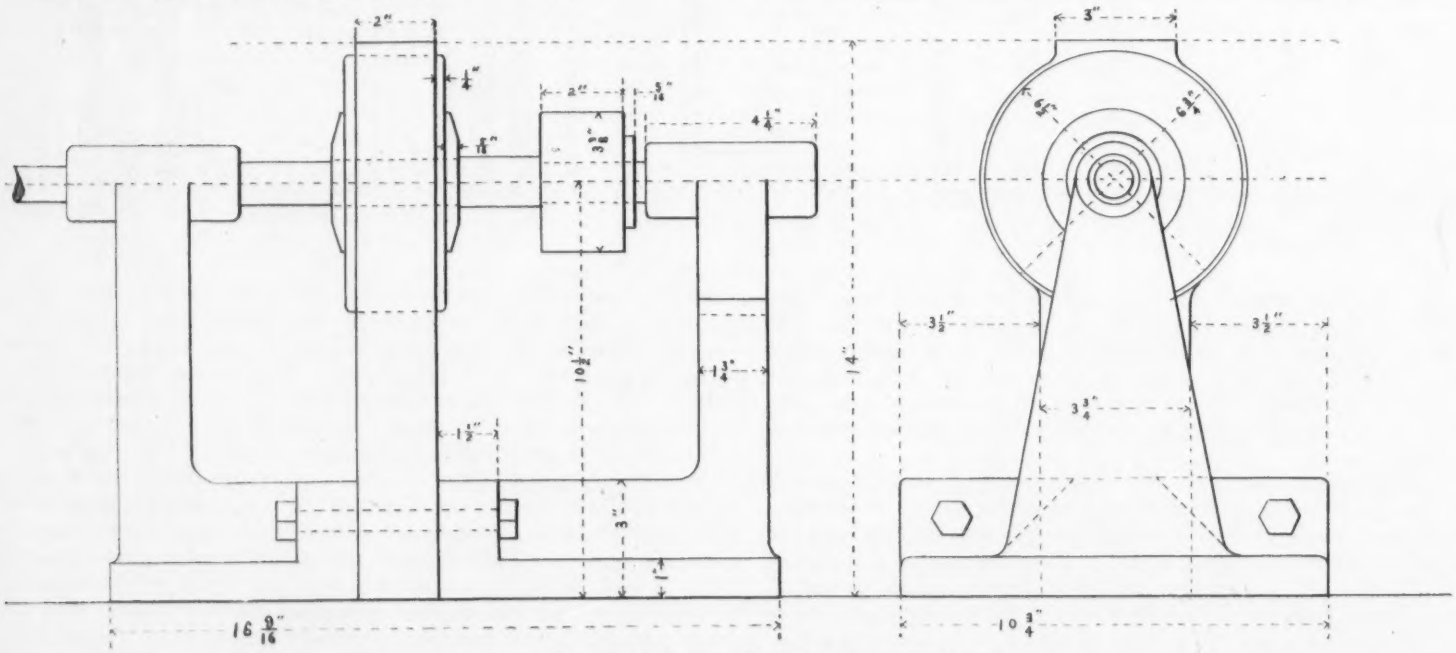


Fig. 1.—Diagram Giving Dimensions of Dynamo.

A Difference Without a Distinction.

For the benefit of those who have occasion to read in the journals about accumulators in Germany, it may be explained here that the "Kalk" accumulator is often referred to as the "Hagen," presumably to confuse it with the "Hagen" accumulator, which is really the "Tudor"; the former is so-called because it is made by a man of that name, and the latter because it is made in a town of the same name.

The Invention of the Electromagnetic Telegraph.

A proof of the editorial which appeared in our last issue, closing the discussion on the subject of the invention of the electromagnetic telegraph, was sent to Miss Henry and to Messrs. Morse and Vail, and the use of our columns offered for any comments they might feel inclined to make upon the views there expressed. The following letters were received in response to this invitation :

To the Editor of The Electrical World:

SIR :—I thank you for the courtesy of allowing me a few words of criticism on your editorial closing the discussion of the telegraph.

1. "*The broad title of the Father of the Telegraph.*" I have used this term myself, but I consider it ambiguous and of no importance. Prof. Morse's claim to it is founded only on an idea held by many before him, and on a local typewriting machine, not essential to the telegraph, and no longer in use.

2. It is stated that the elements of the telegraph should not have been considered in the discussion. A thing is made up of its elements. The telegraph is a complicated affair, and to understand what it is and who gave it these elements, must be considered individually and collectively ; because they have not been so considered, and because what really constitutes the telegraph has not been recognized, the mistake for years has been made of considering a local typewriting machine worked by the telegraph but not essential to it, and giving no more power to produce mechanical action at a distance than any typewriter of this day—as the telegraph itself. This mistake time has made manifest ; the machine has been dropped, and the telegraph does not miss it ; is better off without it.

3. Henry's "*claims for participation in the invention of the telegraph*" are not "*based merely upon the inclusion of the electromagnet as one of its parts.*" Before Henry's discoveries in magneto-electricity the telegraph was an impossibility; not only the magnets did not exist, but the laws which control their relation with the galvanic battery were unknown. All preceding discoveries had culminated only in the Sturgeon magnet, a toy useless in the arts and utterly incapable of action at a distance, as Barlow proved when he tried to make a telegraph with it. Henry's discoveries gave the sensitive instrument which responds to electrical influence at a distance, and the giants, which lift to-day their thousands of pounds; but more than this, his investigations brought to light the different functions of the magnets and their dependence upon different arrangements of the battery. Henry married, as I said, the intensity magnet to the intensity battery, the quantity magnet to the quantity battery; then, opening one circuit by means of the other, he made the sensitive intensity circuit receiving the distant influence, call into action the powerful quantity circuit. He thus made the galvanic combination which rendered possible the telegraph—which is in fact the telegraph. This combination is the means of producing mechanical action at a distance; it is Henry's gift, and its use in the telegraph is only one of many ways in which it may be employed. Volta made the battery, but he made no discoveries with it which made possible the telegraph; these discoveries were Henry's, who found out the laws which controlled it, and the rules which must be followed in its connections with the magnets. I repeat; *the means of producing mechanical action at a distance for the purpose of the telegraph, or for any other purpose, was Henry's gift.* The world is not half grateful enough to him for it. Before his discoveries the electromagnetic telegraph was an impossibility; "science was not ripe for it," but Henry made it ripe. Ampere, Schilling, Sommering, and the 62 claimants mentioned by Wheatstone, made only ineffectual efforts toward an end, in the then state of knowledge, unattainable. They were doomed sooner or later to meet, and did meet, the insurmountable difficulty of the failure of the electrical force with any great extent of wire; even Wheatstone, as late as 1837, ignorant of Henry's investigations, declared the electromagnetic telegraph impossible, because the magnets could not be made to act at a distance. Henry came to him, and told him how to make it a success.

It was only necessary to show the magnet and battery Prof. Morse was using, to prove how little he knew what constituted a telegraph, and what a failure his telegraph was. That battery was utterly incapable of action at a distance; that magnet was utterly incapable of responding to electrical influence at a distance. The office of Prof. Gale, to use my own words, was to lift Morse's receiving machine into Henry's galvanic combination. This is called "*giving advice with respect to scientific details, having no connection with the system considered as an invention.*" These scientific details form the enduring vital part of the telegraph; the machine has been dropped.

I protest against the mention of Henry and Gale as if on the same platform. Gale gave nothing to the telegraph; he merely used Henry's discoveries, and distinctly declared that he did so.

I protest also against the way in which Henry's telegraph is mentioned, not only in this closing article, but in others of the series, as if it were in no way different from the telegraphic efforts which preceded it. These, as I have said, were only ineffectual efforts towards an end, in the then state of science, unattainable. Henry's was the first actual electromagnetic telegraph. It was constructed to illustrate the principles discovered by Henry, which had rendered possible the telegraph ; and, in order to be successful, all the telegraphs which succeeded had to follow these principles. In this telegraph, for the first time, there was no fear of the failure of the electric force, and far from being impracticable, as this closing article calls it, the mile of wire, which represents its length, has been successfully stretched to thousands.

It is said that "*the Morse telegraph is the telegraph of to-day in a modified form, and with what the inventor considered its most important feature omitted, the writing mechanism.*" There is nothing in the telegraph of to-day of Prof. Morse. The writing mechanism, which alone he might have claimed, and which he considered "its most important feature," has been dropped as useless. Look at the apparatus as we talk with it from continent to continent. Whose are the magnets, the one so sensitive to distant influence, the other so powerful ? Henry's. Who pointed out their different functions ? Henry. Who tied them to their respective batteries by that indispensable law of mutual proportion in projectile power and resistance ? Henry. Who made the intensity circuit, bringing the distant influence, open the local quantity circuit, to bring into play the powerful quantity magnet ? Henry. Finally, whose is that simple apparatus in which the armature of a magnet hits a metal sounder, and rings out the message of the telegraph ? Henry's. What is there more ! Nothing. The telegraph of to-day, whose is it ?

I requote Mr. Dickerson: "Now, that apparatus has nothing about it more than was in Henry's Albany telegraph of 1831, nor could it operate if it omitted any of the inventions, either singly or together, which were then for the first time combined. It depends entirely upon the discoveries made by Henry before 1831; and it could not have existed in the world earlier than those discoveries by the use of any means then known to man, nor since by any other means than those discovered by Henry."

The second, or local, circuit was not in the Albany telegraph, but it equally comes under Mr. Dickerson's words.

I have not forgotten the alphabet; this is a most valuable adjunct, but it can hardly be called a part of the telegraph. It should receive its separate meed of grateful acknowledgment.

As to the claims of Vail and others to the alphabet, I know nothing about them; as to those which relate to the "writing mechanism," they have dropped with it out of the telegraph.

To Morse, the Introducer of the Telegraph, I pay again my willing tribute, although I cannot quite second the assertion that on this account he must stand out as "the greatest figure" in the pages of telegraphic history.

MARY A. HENRY.

WASHINGTON, D. C.

To the Editor of The Electrical World:

SIR :—In the article which, through the courtesy of the editors of THE ELECTRICAL WORLD, I was permitted to contribute to the series on "The Invention of the Electromagnetic Telegraph," I tried to be as concise as possible. I wished simply to bring the logic of facts to bear on the evidence which had been adduced for and against the claims of Morse. The temptation in writing of a man like Morse, to dwell on his personality more than on his achievements, is great. Perhaps I erred in confining myself too much to dry facts. In commenting on the able summing up of the editors, my task can only be an agreeable one.

I can find nothing but words of commendation for the tact with which they have acquitted themselves of a difficult task. It is right that all credit should be given where credit is due. It is also right that the name of Morse should go down to posterity as that of the greatest figure connected with the history of the telegraph. This is not the first time that Morse has had to stand the searching test of

a trial of his claims, and as in former trials the decision was invariably in his favor, so now has he secured a verdict. I am sure that the majority of the great audience which has watched the progress of this trial will pronounce it a just verdict.

A man's character is so interwoven with his work for good or evil, that one cannot fully judge of one without an insight into the other. Morse had that rare gift of personal magnetism which won him hosts of friends, and was a large element in his success. He believed in himself. He was an enthusiast in whatever he undertook, and his enthusiasm was contagious. He was quick-tempered and impulsive, too, and he made enemies. But none so ready as he to acknowledge a fault when convinced that he had been in the wrong. If he had never had anything to do with the telegraph he still would have been an eminent man. He was an artist of great talent, and one of the founders and the first president of the National Academy of Design. His name is found in every comprehensive history of art. He would undoubtedly have attained still greater eminence in painting, if he had not turned aside to electricity. He was one of the first, if not the very first, to introduce the beautiful discoveries of Daguerre into America, thus becoming one of the pioneers of photography. He was a controversialist of great skill, and brought deep thought to the discussion of any subject which interested him. He was a man of great generosity and of very slight business ability. He gave away and lost much more than he ever kept, from what the telegraph brought to him. It was hard for him to refuse anybody, and he always answered an appeal most courteously, even when he was compelled to refuse. He had great physical as well as moral courage, and was a sincere and consistent Christian. His indomitable perseverance is too well known to make it necessary for me to dwell on it.

It was the combination of faith in himself with the capacity for sustained and concentrated effort, which entitled him to be styled a genius. He was a good fighter; his life was a constant struggle. Even toward the end of his long and eventful career, when he had passed by a decade the allotted three score years and ten of the life of man, there was no rest for him. In his youth he was forced to wrestle with the grim spectre of poverty. In his prime, imbued with the conviction that he was a divinely appointed instrument, he struggled on amidst the scoffs and jeers of an incredulous world. Then, when scoffs were changed to adulation and jeers to plaudits, he had to fight to keep what he had so dearly won. And he fought to the end.

He was a man of strong sympathies, too, and his interests were extremely diversified. His letter-books make most interesting reading. It is bewildering to try and follow him as he turns from a careful defense of his claims against some new attack to a letter of minute instructions to his gardener. On one page will be a letter consenting to serve on the committee of some charitable institution, and on the next a careful consideration of the merits of some new invention. An acknowledgement of the receipt of a new honor bestowed by a foreign government, or a learned society, will be followed by a charming letter to one of his sons at school. And writing was not easy to him. When we read one of his finished letters, it is so lucid and flows so easily, that no effort is apparent. And yet the rough drafts of these letters show that he wrote and rewrote them, and lavished on them the same conscientious painstaking care which he devoted to everything.

But a thorough discussion of Morse's many-sided character would carry me far beyond the limits of this short article. I should have confined myself to a discussion of the editorial on the series of articles now brought to a close. But I can find nothing to discuss. I can but re-echo the more ably expressed conclusions of the editors. All honor to Prof. Henry and the scientists who proceeded him. All honor to Alfred Vail and to Dr. Leonard Gale. But the first place in our hearts, and in the history of the telegraph to Samuel F. B. Morse.

Edward Lind Morse.

Yonkers, N. Y.

To the Editor of The Electrical World:

Sir:—With your permission I desire to protest against the statement contained in your editorial comments, in your issue of Dec. 28, upon the "Invention of the Electromagnetic Telegraph," with reference to the claims made by and for my father, the late Alfred Vail, as having been the real inventor of the so-called dot-and-dash alphabet. You state that this claim . . . "was bitterly repudiated by Morse. . . . the alphabet was patented in Morse's name, and in a book written by Vail, several sentences occur which . . . specifically indicate Morse as the inventor. . . . The only independent evidence against this is the testimony of one person, and rests upon his recollection a half century later, of what occurred when he was a boy of fifteen."

Permit me to express surprise at either the refusal of the writer of the above to accept other authorities cited by me in my article, which appeared in your recent series, as being worthy of consideration, or at so superficial a reading of that article as to leave no recollection of the testimony I therein cite.

Assuredly, the positive statement in the leading editorial of the New York *Sun*, of Sept. 25, 1858, written by Mr. Moses S. Beach, the then proprietor and editor, and a personal friend of my father's family, and one fully cognizant of the incidents and facts connected with the part taken in the invention by my father, in which editorial he states most emphatically that the dot-and-dash alphabet was invented solely by Alfred Vail; the written statement to the same effect in his article in Scribner's *Hours at Home*, in 1868, by Dr. W. P. Vail, as well as his written private statement later; my own assertion, and that of many members of my father's family, as well as many citizens of Morristown, as having heard my father positively state that he alone was the inventor; assuredly, I repeat, it seems to me that this evidence cannot, in justice to Alfred Vail, or the truth of history, be calmly thrust aside and be completely ignored.

Morse's alleged "bitter" repudiation of my father's claim must have been confined to a very small area, for never to my knowledge did his protest appear in any public manner, and I will be exceedingly obliged for any evidence to the contrary. The fact that the alphabet was patented in the name of Morse, in the light of all that is in legal evidence as to his patents, has no weight whatever; and, too, when the terms of the contract between him and Alfred Vail are considered, and the very fact of the admission in your remarks that no small measure of the successful execution of the apparatus was due to Alfred Vail, all of whose improvements were, it is well known, patented in the name of Morse, argues pretty conclusively against your position with reference to the invention of the alphabet. In other words, as everything that Alfred Vail contributed to the telegraph (and it covered about all there is of the system in use to-day), was patented in the name of Morse, the fact that the alphabet was so patented is no evidence whatever that Morse had anything to do with it.

Alfred Vail never, specifically or otherwise, indicated in his book, or elsewhere, that Morse was the *inventor* of the alphabet, for he therein stated only that "this conventional alphabet *originated* with Prof. Morse," which is somewhat different from asserting that Morse *invented* it. That this alphabet (the dot-and-dash) was "conventional" cannot be questioned, for it was an evolution from the V-shaped characters produced by Morse's pencil pendulum with this exception, that Morse's apparatus was incapable of producing a dot or a space, for the reason that the point of the pencil never left the paper, which, passing under it, received the marks of the pencil.

The operation of the electric current in producing intelligent results is most arbitrary, and absolutely requires the opening and closing of the circuit of electricity, and consequently dots, dashes, and spaces, whether the former are the points of V-shaped characters or not, must result. The question at issue as to the dot-and-dash alphabet is then, who was it that, having devised the mechanism to produce (what Morse's apparatus could not) dots, dashes and spaces, so arranged these divisions as to represent the letters of the alphabet?

That the change in the mechanical part of Morse's original apparatus, after Alfred Vail entered into partnership association with him, was effected by the mechanical skill and inventive genius of the latter is, I think, pretty generally conceded, and there is plenty of testimony to support the position. Is it a difficult thing to believe that when Alfred Vail found that the mechanical changes he had made in Morse's apparatus permitted, in fact required, that a radical change be made in the characters used in communicating intelligence, he should have provided them by devising the alphabet, which rendered useless the cumbersome vocabulary and leaden type of Morse's crude instrument? As before mentioned, under the terms of the contract, these improvements were patented in the name of Morse.

No intention exists on the part of any of Alfred Vail's friends to deprive Morse, Henry or any other of all that is justly due them, but the injustice of treating Morse as the only one whose name should be linked with the greatest invention of the world is one that every

honest-minded citizen should deprecate, and my humble efforts shall never cease, so long as the power remains, to obtain for my father, Alfred Vail, the full share of honor and renown due him for his great part—second to none—in the invention of the electromagnetic telegraph.

STEPHEN VAIL.

MORRISTOWN, N. J.

[The sentence in our editorial, part of which is quoted in the first paragraph of Mr. Vail's letter, is as follows:

"Morse's unquestioned prior invention of an ingenious sign code for the same purpose is presumptive evidence in his favor; the alphabet was patented in Morse's name, and in a book written by Vail several sentences occur which, *unless a most improbable construction is placed upon their meaning*, specifically indicate Morse as the inventor, *and with no qualification implying that the writer had any share in the invention.*" The italics are ours. The letter of Mr. E. L. Morse in the same issue, contains evidence still further strengthening the view expressed in the above quotation.

By independent evidence was meant evidence originating from other than one and the same source. All of the evidence in the discussion bearing on this point as affecting Vail's claims, had, as we could see, and aside from the Baxter testimony, the same origin, though advanced by different persons. We did not ignore the claim of Alfred Vail to the invention of the dot-and-dash alphabet, but as between two claimants, expressed the opinion that one had a greater weight of evidence in his favor than the other.

We, perhaps wrongly, took it for granted that the annotation of Morse in the pamphlet attributed to F. O. J. Smith, declaring the claims made for Vail to be "false," referred particularly to the claim for the alphabet, which is by far the most vital one. The claim, however, was specifically, if not "bitterly," repudiated by Morse in an annotation quoted by Mr. E. L. Morse, as follows: "See page 30 (Vail's book) for a complete refutation of the hint in *Hours at Home* that Mr. Vail invented the Morse alphabet, so called."

In closing the controversial series of articles on "The Invention of the Electromagnetic Telegraph," we felt that it not only lay within our province to express opinions based upon the facts presented, but that it was a duty to our readers for us to do so. Notwithstanding the bearing of these opinions, we still heartily concur in the following estimate of Alfred Vail, quoted from the article in this series contributed by the late Franklin Leonard Pope:

"And it ought to be said in the outset, and this without disparagement of some of the others who have been named, that few men have lived whose characters compel a higher meed of admiration and praise, for integrity of purpose, considerate regard for the feelings and rights of others, and high ambition to serve the interests of their fellow-men rather than themselves, than Samuel F. B. Morse and Alfred Vail. This may seem a strange statement to make, in view of some of the circumstances of the case, but it is nevertheless made without qualification or reservation, in the full belief that the few occurrences which at first sight seemed inconsistent with such a verdict are susceptible of satisfactory explanation. Most of the controversies between honest and well-intending persons in this world result from pure misunderstandings and misconceptions; sometimes arising from causes wholly accidental, but more often set on foot and fanned into a flame by the crafty malice of third parties for the better serving of their own selfish ends."—ED.]

Current Splitting.

To the Editor of The Electrical World:

SIR:—Referring to the letter of Mr. Charles S. Bradley, printed in your issue of Dec. 28, the 8.6 per cent. loss referred to in my note of Dec. 7, is not the total loss in the motor, but the additional loss due simply to splitting a single-alternating current into two currents differing in phase. To get the total loss we must add to this the electrical and mechanical losses in the motor itself. If the motor have an efficiency of 88 per cent., the total loss in motor and phase-splitting device will be 20 per cent.

With small motors an additional loss of 8 per cent. is of no consequence, as Mr. Bradley very truly remarks, because such motors are not very efficient in any case, and the advantages far outweigh the extra loss. I have no wish to deny this. What I said was: "This method must always be handicapped to such an extent as to render its use impossible *where fairly large units of power are required.*" My remarks therefore (and I presume the editorial, since the question of small units was not raised) referred only to large units, say above 50 horse-power, and I believe them to be correct. For 8.6 per cent. additional loss due to using this system would mean, with power at $25 a year, that a consumer with a 100-hp motor would pay a bill of $200 per year more than if he were using the plain two-phase system, the bill for power being based on minimum demand. If the bill were based on meter, the handicap would be still greater.

My remarks were not intended to apply especially to Mr. Bradley's method; the transformer and condenser have been used very generally by a number of experimenters for the purpose of producing phase difference. I believe however that the considerations I have presented apply to Mr. Bradley's ingenious modification as well as to the ordinary method, for though Mr. Bradley states that the bulk of the energy is stored in the condenser, I have been unable so far to see, if this be the case, how the 90-degree relation is maintained at different loads, as shown in the diagram published in the Institute proceedings.

My remark upon the method of storing the energy by means of momentum was based upon general principles merely. I have not attempted to work out a general method. I was aware that the momentum effect was used in some of the motors already experimented with (as, indeed, in the monophase and synchronous motors when running at full speed), and had no idea of giving the impression that the plan was original, but merely that it was to be preferred to the alternative one of storing the energy in iron and dielectric. Though I had missed Mr. Bradley's patent in which this effect is made use of, I was acquainted with Lieut. Patten's work, and should have referred to it had I been aware the difficulties to be met with in putting it in practical operation had been overcome. I am glad to know that this is the case and hope the time is close at hand when we shall see such devices in commercial working.

It is to be noted that lighting transformers will not give good results when used for phase-changing. A transformer considered as a means of converting energy has its highest efficiency, approximately, when the induction is such as to make the copper loss equal to the iron loss. Therefore, in order to get a high all-day efficiency, transformers are generally built so as to have their highest efficiency at one fourth to one half load, according to the amount of drop allowed in the secondary. If they be built for maximum efficiency at half load, then at full load the copper loss will be three fourths the iron loss. If such a transformer were used for phase-splitting, then, instead of adding 2 per cent., as I did in my note of Dec. 7, for copper losses, we must add 7 per cent., making the total handicap 13.6 per cent. If, therefore, the chief function of the transformer be to store energy, we should take lots of iron, low induction and little copper.

REGINALD A. FESSENDEN.

ALLEGHENY, PA.

Trolley Cars on the Brooklyn Bridge.

President Howell, Trustee Keeney and Superintendent Martin are opposed to the running of trolley cars over the Brooklyn Bridge, as set forth in a proposition made by the Nassau Electric Railway Company, which wants to lay tracks on the bridge roadway to transport its passengers to and from the New York side of the bridge. Mayor Schieren considers the plan entirely feasible, but intimated very plainly that it would never be adopted by the present Board of Trustees, owing to the opposition of Messrs. Keeney and Howell, who are interested in a rival street railway company. President Rossiter, of the Brooklyn Heights Railway Company, also has a plan for running trolley cars across the bridge, which, however, does not provide for tracks on the present roadway, but a roadway on an elevated structure over the bridge, bringing the weight on the outer cables, and not on the present iron supports of the structure, which he considers not strong enough for the purpose. The plan of the Nassau Company proposes to lay one track on each roadway, and to put in a three-groved rail, with an opening only three quarters of an inch wide, for the wheel flanges, so that wheels of carriages and wagons would not slip into them.

A New Electrical Phenomenon.

The Kansas City *Star* recently contained an account of an accident from electric shock to a 10-year-old boy, in which it is stated that on examination by a surgeon of the injured youth it was found that his teeth were electroplated the color of silver. The reporter adds that it is quite usual for the teeth of people who are killed by electricity to become electroplated, and that when the teeth are so affected, death is almost sure to follow!

DIGEST OF CURRENT TECHNICAL ELECTRICAL LITERATURE

BY CARL HERING

COMPILED FROM THE PRINCIPAL FOREIGN AND AMERICAN JOURNALS

Abbreviations Used in the Digest.—The following is a list of some of the more important abbreviations used in this department for the titles of the electrical journals which are referred to. There are many other journals which are abstracted and noticed, the titles of which are either given in full or are abbreviated in such a way that their full title is easily recognized.

ENGLISH, ELECTRICAL:

Electrician	Lond. *Elec.*
Electrical Review	Lond. *Elec. Rev.*
Electrical Engineer	Lond. *Elec. Eng.*
Journal of the Institution of Electrical Engineers	*Jour. Inst. Elec. Eng.*

ENGLISH, NON-ELECTRICAL:

Engineering	Lond. *Engineering.*
Philosophical Magazine	*Phil. Mag.*
Abstracts of papers in Foreign Transactions. Proceedings of Institution of Civil Engineers.	*Foreign Abstracts. Inst. Civ. Eng.*
Proceedings of the Physical Society of London.	Lond. *Proc. Phys. Soc.*

FRENCH, ELECTRICAL:

L'Industrie Electrique	*L'Ind. Elec.*
L'Eclairage Electrique	*L'Eclairage Elec.*
L'Electricien	*L'Elec.*
L'Energie Electrique	*L'Energie Elec.*
Bulletin de L'Association des Ingenieurs Electriciens Montefiore;	*Bul. l'Ass. Ing. El. Montefiore.*
Revue Internationale d' Electrotheraphie	*Rev. Ind. d'Electrotherapie.*

FRENCH, NON-ELECTRICAL:

Revue Générale des Sciences	*Rev. Gen. des Sc.*
Memoires, Société Ingenieurs Civils	*Mem. Soc. Ing. Civ.*
Revue Industrielle	*Rev. Ind.*
Moniteur Industriel	*Moniteur Ind.*
Journal de Physique et de Chemie	*Jour. Phys. et Chem.*

SWISS:

Revue de L'Electricité	*Rev. de L'Elec.*
Journal Telegraphique	*Jour. Teleg.*

BELGIAN:

Bulletin de la Société Belge d'Electriens	*Bul. Soc. Belge d'Elec.*

GERMAN, ELECTRICAL:

Elektrotechnische Zeitschrift	*Elek. Zeit.*
Elektrotechnischer Anzeiger	*Elek. Anz.*
Elektrotechnisches Echo	*Elek. Echo*
Electrochemische Zeitschrift	*Electrochem. Zeit.*
Zeitschrift fuer Elektrochemie	*Zeit. f. Electrochem.*
Deutsche Zeitschrift fuer Electrotechnik	*Deut. Zeit. f. Elek.*

GERMAN, NON-ELECTRICAL:

Zeitschrift fuer Beleuchtungswesen	*Zeit. f. Beleucht.*
Wiedemanns Annalen	*Wied. Ann.*
Zeitschrift fuer Physik und Chemie	*Zeit f. Phys. u. Chem.*

AUSTRIAN:

Zeitschrift fuer Elektrotechnik	*Zeit fuer Elek.*
Electro-Techniker	*Elec. Tech.*
Wiener Berichte	*Wien. Ber.*

ITALIAN:

L'Elettricista	*L'Elettricista.*

JAPANESE:

The Electrical Friend	*Elec. Friend*

AMERICAN, ELECTRICAL:

Electrical Engineer	*Elec. Eng.*
Electrical Review	*Elec. Rev.*
Western Electrician	*West. Elec.*
Electricity	*El'ty.*
Electrical Age	*Elec. Age.*
Electric Railway Gazette	*El. Ry. Gaz.*
Electrical Journal	*Elec. Jour.*
Journal of Electricity	*Jour. of El'ty.*
Electric Power	*Elec. Power*
Electrical Industries	*Elec. Ind.*
Electrical Engineering	*Elec. Eng'ing.*

AMERICAN, NON-ELECTRICAL:

Street Railway Review	*St. Ry. Rev.*
Street Railway Journal	*St. Ry. Jour.*
Engineering Magazine	*Eng. Mag.*
Cassier's Magazine	*Cassier's Mag.*
Engineering News	*Eng. News.*
Engineering & Mining Journal	*Eng. & Min. Jour.*
Scientific American	*Sc. Amer.*
Scientific American Supplement	*Sc. Amer. Sup.*
Progressive Age	*Prog. Age.*
The Physical Review	*Phys. Rev.*
Journal of the Franklin Institute	*Jour. Frank. Inst.*
Proceedings American Association for the Advancement of Science	*Proc. Am. Ass. Adv. Sc.*
Transaction of the American Society of Civil Engineers	*Trans. Am. Soc. Civ. Eng.*
Proceedings of the Engineers' Club of Philadelphia	*Proc. Eng. Club Phila.*
Transactions of the American Society of Mechanical Engineers	*Trans. Am. Soc. Mec. Eng.*
American Journal of Science	*Am. Jour. of Sc.*
Popular Science Monthly	*Pop. Sc. Mo.*

COLLEGE JOURNALS:

Sibley Journal of Engineering	*Sibley Jour.*
Technology Quarterly	*Tech. Quart.*
School of Mines Quarterly	*Sch. of Mines Quart.*
Quarterly Bulletin	*Quart. Bul.*

DYNAMOS, MOTORS AND TRANSFORMERS.

Theory of Non-Synchronous Motors. GOERGES. *Elek. Zeit.*, Dec. 12; continued, see *Digest*, Dec. 21. No general conclusions are reached.

Formers for Armature Coils. El. Ry. Gaz., Dec. 21. An illustrated description of some new types of formers, which were found useful in practice.

LIGHTS AND LIGHTING.

The Electric Arc. AYRTON. Lond. *Elec.*, Dec. 13, continued; see *Digest*, Nov. 30.—Gives an analytical treatment of the relations which have been discussed graphically; the formulas are developed and illustrated in each case with an example. The principal formulas are as follows: E is the E. M. F. of the generator in volts; r, the total resistance in ohms in the circuit outside of the arc itself; V, the voltage between the carbons; A, the amperes in the arc, and l, its length in millimetres. The other letters used in the formulas represent the constants given in the formula, which was reprinted in the *Digest*, Aug. 24, and depend on the carbons used. For a 11 mm positive carbon and a 9 mm negative, both solid, the constants are $a = 38.88$, $b = 2.074$, $c = 11.66$, and $d = 10.54$. If the voltage of the generator is known, as also the external resistance in the circuit, the longest silent arc that can be maintained, and the smallest current that will flow, are given by the following formulas:

$$l = \frac{E-a}{b} + \frac{2dr - 2\sqrt{r\,[bd\,(E-a) + d^2 r + b^2 c]}}{b^2}$$

$$A = \frac{\sqrt{r\,[bd\,(E-a) + d^2 r + b^2 c]}}{b\,r} - \frac{d}{b}.$$

When the voltage of the generator is known, and it is required to maintain a silent arc of fixed length, the maximum external resistance that can be used, and the smallest current are given by the following formulas:

$$(E-a-bl)^2 - 4\,r\,(c+dl) = 0$$

$$A = \frac{2\,(c+dl)}{E-a-bl}.$$

When the voltage of the generator is known and the current is fixed, the minimum external resistance that must be placed in circuit and the maximum length of silent arc that can be maintained, are given by the following formulas:

$$r = \frac{d(E-a) + bc}{A(Ab + 2d)}$$

$$l = \frac{A(E-a) - 2c}{Ab + 2d}.$$

She then discusses the ratio of the power expended in a silent arc and the power generated by the generator (undoubtedly always referring to arcs on constant-voltage mains); this ratio of the powers is important in determining the most efficient arrangement; she concludes that in silent arcs of from 1 mm to 7 mm, with solid carbons, the ratio of the power expended in the arc and the power developed by the generator, is greatest when the arc is shortest, when the current is the largest that does not cause hissing,

and when the voltage of the generator is the smallest possible. The length of the arc is the most important variable to choose first, in making any arrangement to maintain an arc, as it is known definitely that this length should be as small as possible; to decide on the length of arc, the current and voltage which will give the largest ratio of the light emitted to the power developed in the generator, it is necessary to find what length of arc gives the greatest amount of light for the energy consumed when the current is the largest that does not cause hissing. The ideal conditions to be striven for in an arc, to get the best power ratio, are that the arc should be as short as possible, that the current be the largest that will certainly give a silent arc, that the regulator should start feeding for as small a diminution of current and as small an increase in the length of the arc as possible, and that the voltage of the generator should be the smallest that will send this diminished current through the increased length of arc.

The Arc Light. THOMPSON. Lond. *Elec. Rev.*, Dec. 13; continued, see *Digest*, last week.—He continues the description of the mechanisms in a number of the typical lamps.

Parabolic Mirror. REY. Lond. *Elec. Eng.*, Dec. 13.—He discusses theoretically the illumination produced by a parabolic mirror when the light is spherical and when it is plane; the formulas are claimed to be rigorously exact if the size of the source is negligibly small as compared with that of the mirror.

Regulating Lamp Socket. ANTHONY. *Elec. Eng'ing*, Dec. 25.—He gives the results of tests made to measure the energy in an incandescent lamp whose candle-power is regulated by the vibration contact-breaker in a vacuum, described two years ago by Mr. Moore, the object of which is to dim the lamp by cutting off the current for a definite fraction of the time. The vibrator, except the magnet, is placed inside of a small tube, smaller than a lead pencil, the magnet being on the outside; the apparatus scarcely becomes warm, and there is hardly a visible spark, from which he concludes that it cannot consume much energy. In the tests the lamp was also dimmed by introducing external resistance, and a comparison of the results is given, also the values of the energy consumed computed on the assumption that the vibrator consumes no energy; with a 16-cp lamp run below 4 cp the results differ but little from the mean value of the current deduced and the assumption that the entire energy was consumed in the lamp; up to 2 or 3 candle-power the vibrator worked satisfactorily, but for a higher incandescence its action was somewhat irregular. He concludes from his experiments that a lamp can be successfully cut down in candle-power by means of this vibrator, which does not consume more energy than the lamp.

Arc Lighting Progress. DOW. *Elec. Eng'ing*, December.—He discusses the design of large central stations for arc lighting, advocating large units and pointing out the advantages of alternating currents in this direction. He compares alternating and continuous arc lights. Progress in arc-lighting in the last two years, he believes, was mainly in the adoption of large direct-current units of higher efficiency than the earlier machines. He believes the progress in the next few years will be confined mainly to alternating-current lamps and systems of distribution. There is much room for the improvement of minor details, such as globes, carbons and insulation.

Tapering Carbons. PORTIS. *Elec. Eng.*, Dec. 18.—A brief description of a patent for carbons, electroplated with metal, which increases in thickness toward the unpointed end, the argument being that as the carbons burn away there is more energy available to dissipate the coating of the electrode; to "absorb this additional energy" the present method was devised.

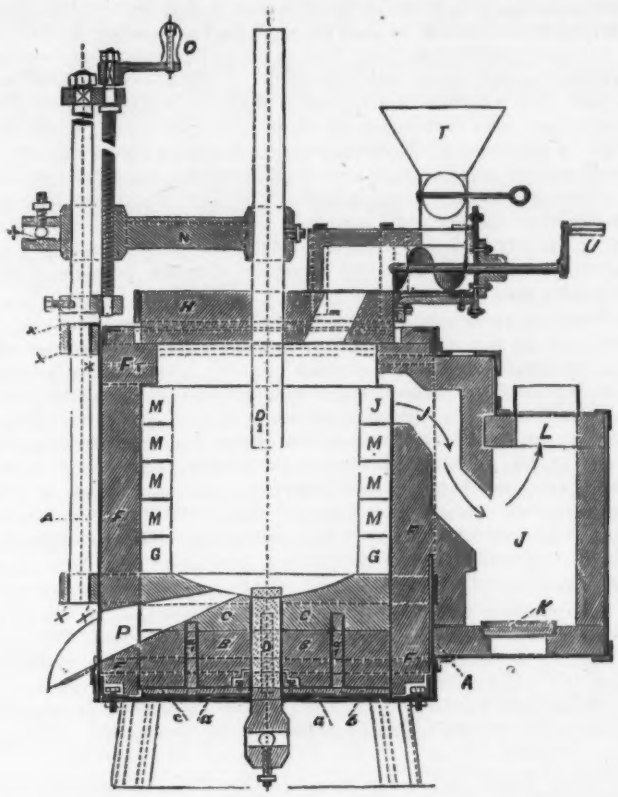
Crompton Arc Lamp. Elec. Eng., Dec. 25.—A reprint of the description by Prof. Thomson in his lectures on the arc light, *Digest*, Dec. 28.

POWER AND HEAT.

Elevator to the Top of Mt. Blanc. Elec. Tech., Nov. 30.—A short note to the effect that a French engineer, Mr. Isartier, is projecting a plan which it is thought may be carried out if the necessary capital can be obtained. From a point above Chamounix at a height of 2200 meters above the sea, a tunnel is to be run to a point in the mountain vertically below the top; the length of this tunnel will be 5700 m; from there a vertical shaft is to be run to the top, the length of which will be 2539 m (about 1.5 miles high!) and which is to be bored by means of a caisson, containing the boring machinery, and is to be moved up gradually as the work progresses; the power is to be derived from the numerous neighboring water-falls; 600 horse-power is thought to be sufficient for boring the tunnel; there is to be a hotel at the entrance to the tunnel and another at the top of the mountain; the ascent is to be made in 30 minutes by means of a "four-story" electric elevator. No further information is given.

Transmission of Power for Dock Pumping. Lond. *Elec.*, Dec. 13.—A plant is to be erected at North Shields for a floating dock which will be one of the largest ever built; the pumping will be done by eight centrifugal pumps, each coupled to a 60-hp electric motor; the shafts will be vertical, the pump being at the bottom and the motor at the top of the dock; the switches and resistances for starting and stopping will be placed together at a point at one end of the dock and under absolute control of a single attendant; the current is generated in a stationary plant 200 yards from the dock and connected to it by a cable; the plant is capable of pumping about 16,000 tons of water per hour through a mean head of about 18 feet, so that it will be possible to raise a dock loaded with a ship of the largest tonnage in the short space of half an hour, which is the fastest ever attained; it replaces a steam plant which was connected to the stationary plant with a flexible steam pipe, an arrangement which was unsatisfactory; the generator plant will be capable of working three docks, which will never be operated simultaneously.

Electric Furnaces. Zeit. f. Electrochem., Dec. 5.—A brief, illustrated description of a furnace sold by a German firm. Referring to the accompanying illustration *MM* is a refractory lining of magnesia; the lower



ring *GG* and the bottom of the furnace *CC* are of graphite; the arc is formed between the upper carbon, which is regulated by hand, and the one through the bottom of the furnace, as shown, the latter being the negative; to start the arc it is preferable to connect the two carbons with a thin carbon rod in order to avoid too great a rush of current. The materials are supplied through the funnel *T*; the gases formed pass out through the chamber *J* in which are deposited any solid particles carried along by the gases; the molten material passes off through *P*, which is at first closed with a plug of carbon. At the bottom of the furnace at *C* is a layer of asbestos over which there is a plate of iron containing 4 iron bolts passing upward into the blocks of graphite from the bottom, the object of which is to lead the current into the furnace with as small a loss of power as possible; the upper carbon is insulated from the furnace at *XX*.

Alternating-Motors for Pumping. Lond. *Elec.*, Dec. 13.—An illustrated description is given of the works at Worcester, where the pumps are run during the day. The generating-station is located at some distance, and the current is therefore transformed down to 100 volts for the motors. There are two pumps, each with a capacity of 10,000 gallons per hour against a 300-foot head. There is a fast and loose pulley, with a striking gear; each has a capacity of 30 hp, and they are of the alternating-current, non-synchronous type; they appear to need very little attention, as the pumping room is often left and locked up for a considerable time.

Destructors. Lond. *Elec. Rev.*, Dec. 13, editorial.—It was thought that the subject had received a severe check within the last year or two owing to ill-considered statements and claims of a certain company; the value of a refuse destructor plant as an economical auxiliary to an electric lighting plant is now being tested on sufficiently broad lines, and the results will soon be known and will enable opinions to be formed; it is thought that the most experienced central-station managers in London and the provinces do not regard refuse destruction as of importance at the present time except on purely sanitary grounds. A recent paper of Mr. Manville for the Northern Society of Electrical Engineers is mentioned and referred to. He considers that the cost of producing electricity will be materially reduced by the utilization of the heat from destructors, and estimates the reduction at about one third of the present average cost, but it is thought that anything approaching this figure has yet to be proved in practice. A combination of refuse destruction, thermal storage and electric lighting may alter unfavorable opinions. The results of thermal storage have been encouraging. It is thought that oversanguine views concerning destructors have been held by many

engineers. The advantages are purely financial and must therefore be judged by the balance sheet. At present no favorable balance has been shown.

Direct vs. Alternating Currents for Long-Distance Transmission. Baxter. *Elec. Eng.*, Dec. 18; concluded; *Digest*, last week.—Owing to the fluctuations of the alternating voltage he claims that with the direct system the voltage, as far as it is limited by the insulation, may be made 40 per cent. greater; he discusses the question of whether continuous-current dynamos may be built for such high voltages and to prove that they may be, he cites the case of arc-lighting machines which are run under great disadvantages, from which he concludes that if the conditions are more favorable they might be used for much higher voltages; he believes there is "no difficulty whatever" in constructing a constant-potential generator for 15,000 to 20,000 volts which will not spark at the commutator, and believes that all which is required is that the voltage between the commutator sections be so low as to be incapable of causing a spark; a number of machines might be used in series without bringing the cost of the direct-current plant up to that of the alternating; he claims there are in use a large number of railway generators whose commutators have not worn down more than 0.08 to 0.10 inch in the last three years; "if difficulties are encountered in making apparatus that will work well at these high electromotive forces they will be combated until a practical means of overcoming them is found."

Polyphase Plant in the Soignies Quarries. West. Elec., Dec. 28.—A brief, illustrated description from the French; the plant was formerly operated by steam with a consumption of 4 to 5 kg of coal per hp-hour, which with the present plant has been reduced to 1 kg; a 3-phase generator is used, besides a continuous-current dynamo; the former delivers about 246 hp, most of which is used for power purposes and a part for lighting; 123 hp is used in six motors for power purposes; there is said to be "little to choose" between the continuous and alternating currents from a technical, economical or financial standpoint; the projectors are said to be "entitled to much credit for their daring in thus hazarding the experiment."

Electric Smelting Furnace. Vincent. *Elec. Eng.*, Dec. 25.—An illustrated description of a design for one in which the operation is continuous; the arc is formed between two large blocks of carbon, the upper one of which is adjusted by means of a series-solenoid to keep the arc constant; the pulverized ore is forced in from the side by means of a feeding screw; the molten product runs into a pit, where it is collected; the furnace is said to be specially adapted for the production of calcium carbide.

Selection of Steam Engines for a Lighting Plant. Crocker. *Elec. Eng.*, Dec. 25.

TRACTION.

Accumulator Traction. Sarcia. *L'Ind. Elec.*, Dec. 10.—A long article pointing out more particularly the advantages of recovering energy on down grades and charging the batteries with it; he refers also to a number of experiments made with a car on the St. Denis accumulator line covering a period of 100 trips, during which all the energy used was measured as also that which was recovered. The motors are separately excited and there is an adjustable resistance in the field, as also in the armature circuit, the latter being used only for obtaining a more gradual starting; by adjusting the field rheostat the voltage of the motor when running as a generator may be made higher than that of the batteries so as to charge them. He discusses analytically the calculation of the coefficients of traction and the recovery of the energy, assuming an efficiency of 70 per cent. for the accumulators; for the coefficient of traction in kgs per ton he uses that measured at the electrical terminals of the motor and it therefore includes all the subsequent losses; from a number of experiments he finds that the lowest value of this is 7.6 kg per ton on the Vignole rails outside of Paris, and the largest value is 15.7 for the Broca rails in the city itself. He obtained a quantity which he called the coefficient of recuperation, which is 0.7 times the ratio of the energy recovered in the battery to that required in mounting a grade, and he gives its value in curves and tables as a function of the grade; for a coefficient of traction of 10 kg per ton, for instance, on a level and on a grade of 0.10, there is recovered 57 per cent. of the energy spent in mounting it, the amount of energy recovered diminishes with the grade; it is only 42 per cent. for a grade of 0.04, and 23 per cent. on one of 0.02. It is zero on a grade of 0.01. With a coefficient of traction of 5 kg per ton, at the terminals of the motor, 63 per cent. of the energy on a grade of 0.01 is recovered. This shows the importance of diminishing as much as possible the coefficient of traction on a level, in order to obtain as much recuperation as possible. He discusses at some length the coefficient of traction on the level, showing how it may be calculated with sufficient approximation from the electrical measurements, for all different grades and different loads, giving the results obtained in tests made for the purpose. He finds that it is not constant, but increases slightly with the grade, which is due to the fact that the energy is measured at the terminals of the motor; the mean of all his values is 11.23 kg per ton on the Broca rails, which is 40 per cent. higher than that on the Vignole rail, on which it was 8.06. In conclusion he makes a comparison of the energy used by a trolley car and that used on an accumulator car, assuming an efficiency of 30 per cent. for the motors of the former, and even this he considers higher than the average; taking the same car and adding accumulators he makes a similar calculation for a round trip, taking into account the amount of energy recovered on the down grades; from the tables and curves he shows that with a car without passive resistance, when equipped with motors having an efficiency of 100 per cent., a battery of 10 tons can be added without consuming more energy than a trolley car, on a round trip and a grade of 20 in 1000. He shows, with the aid of tables and curves, that with the same coefficients of traction it is possible to increase the weight of the battery on increasing grades, and consume no more energy than with the trolley car; with a coefficient of 12 kg per ton and on a grade of 20 in 1000 it is necessary to reduce the weight of the battery to 1400 kg in order to consume no more energy than with a trolley car, while on a grade of 40 the same result will be obtained with a battery of three tons; with a perfect car having no passive resistance and motors having an efficiency of 100 per cent., a battery of 10 tons can be used, a weight equal to that of the car, without consuming more energy than with a trolley car, on any profile which is not absolutely horizontal; this weight diminishes rapidly with the traction effort and it shows the importance in accumulator traction of diminishing the electric and mechanical resistances as much as possible; with the new car on that line, on which the coefficient of traction is 11 kg per ton on the Broca rail, a battery of 4 tons may be used for a grade of 40 in 1000, using the same amount of energy as on a trolley car; as the weight of the battery is only 2 tons there is an advantage in favor of the accumulator car on that part of the line.

Accumulator-Traction. Lond. *Elec.*, Dec. 13; editorial.—It is thought that the electrical industry has yet to produce a battery which is commercially adapted to the conditions of traffic, and its non-existence is one of the most serious hindrances to electrical progress, possibly the most serious of all. Although a real commercial traction-battery cannot be said to exist, it does not care to assert that the outlook is quite hopeless.

Electric Bicycle. Pingault. *L'Ind. Elec.*, Dec. 10; a description by Mr. Arnoux before the *Soc. Int. des Elec.*—With these machines a man is said to be able during one hour to keep up a speed of 50 km (30 miles) per hour. In addition to the power of the rider, which is exercised in the usual way, there are two electric motors placed behind the saddle, which are mounted on the same shaft, carrying a wooden pulley which acts by friction directly on the pneumatic tire of the rear wheel, thus enabling a very high-speed motor to be used, which reduces the loss in the transmission-gear and the weight of the motors; the current is furnished by a battery of accumulators placed in the frame; they are grouped into four sets, which can be variously connected with the motors, as usual; the accumulators are not described, but they are said to be able to generate up to 25 watts per kg of total weight (11.4 watts per pound); the greatest speed attained was 72 km (43 miles) per hour, for several minutes; the weight of the machine ready for use is 90 kg (198 pounds) of which 14 kg is for the bicycle and 45 for the accumulators and 30 for the motors, controller and accessories; in a new model under construction the weight will be reduced to 75 kg (165 pounds); the accumulators can deliver 1500 watts for one hour or 900 during four hours. Editorially it is stated that if the result is only one third as good as that claimed, it solves the problem of the electric carriage, "the carriage of the Twentieth Century."

Mechanical Traction on Railways. Pellissier. Lond. *Elec. Rev.*, Dec. 13.—Translation in brief of a long article in *L'Eclairage Elec.*; it refers chiefly to results obtained in this country.

Accumulator Traction. West. Elec., Dec. 28.—Satisfactory progress is being made with the line in Chicago and it is thought that some of the cars will be in operation in April; the company has a franchise for 54 miles of road; there will be 50 motor cars and 50 trailers: each of the former will contain 4500 pounds of chloride accumulators and two motors of 25 hp. The claim is made that in 7 minutes the cells can be charged sufficiently to run a car 40 miles; "this seems surprising, but the statement is confidently made"; a battery can be replaced by another in 3 minutes; the maximum speed will be 25 miles an hour; the president believes this line will demonstrate that an accumulator road may be operated better than a trolley road from a financial point of view.

Surface Contact System. Lundell. *Elec. Eng.*, Dec. 18.—A brief, illustrated description of some recent improvements in his system, intended to lessen the cost and to minimize the liability of leaving a section alive after the car has passed over it; the construction of special crossing apparatus is avoided.

Non-Arcing Controllers. Short. *Elec. Eng.*, Dec. 18.—A brief illustrated description of a patent; a magnetic field is created at the points where sparks are apt to occur; these fields are made by an electromagnet having numerous alternately opposite poles projecting over its side, which pass in between the contact points; there is a magnetic circuit for each contact, and the field is concentrated within very small air gaps.

Some Difficulties of Electric Railroading. Amer. Eng., Dec. 12.—An anonymous article calling attention to some difficulties, among which are the placing of two motors on a single car, and the present use of gears, both of which are said to be "the two great bugbears of electric traction"; a third is the method of supporting the motor on the axle and

making it liable to all the pounding of the wheels; an attempt is said to have been made to mitigate this trouble in a motor in which only about one third of the weight is thrown on the axle while the rest is supported on a spring-like cushion; it is thought that the difference in dollars and cents in a year due to a reduction of the weight from 2500 to 500 pounds on a car axle would be a "startling exhibit." "It is difficult to see how a combination can be designed that will obviate all the troubles that exist."

INSTALLATIONS, SYSTEMS AND APPLIANCES.

Board of Trade Definition of Low Pressure. Lond. *Elec.*, *Elec. Rev.*, *Elec. Eng.*, Dec. 13.—A brief report of the committee to the Board of Trade, consisting of Lord Kelvin, Mr. Preece and Major Cardew. They recommend that 500 volts continuous, or 250 volts alternating, should be classed as low pressure, while high pressure is up to 3000 for either; with certain exceptions, the pressure of supply delivered to any consumer shall not exceed 250 volts at any pair of terminals; no conductor shall be at a higher pressure than 300 volts from the earth; it is provided that no change shall be made in the voltage supplying any consumer, as a consequence of these regulations, except with his consent; with 500 volts continuous pressure, between the outer conductors in three- or five-wire system, having bare conductors laid in conduits, a provisional sanction may be given to an earth connection applied to one point of the middle conductor, if high insulation is maintained at all other points of the system, and if suitable and sufficient means are provided for the immediate detection, localization and correction of any fault in the insulation. The former journal thinks these conclusions are of a debatable nature, and that the advantages of allowing a higher voltage will entirely vanish owing to the provision that the change may be made only with the consent of the consumer, as it is not likely that this general consent can be easily obtained; it questions why a difference was made between systems of bare wires and those in which the wires are insulated; with either system it is thought absolutely necessary to not only sanction but to insist on the earthing of the neutral; the distinction between the alternating and the direct current is considered to be invidious, and there seems no reason why alternating currents should be just twice as deadly as the continuous; if the fatal effects are proportional to the maximum values, then about 350 volts should be considered equally as safe as 500 continuous; there is furthermore a deadly gripping nature of the continuous-current shock as compared with the well-known kicking-off effect of an alternating one.

Triangle and Star Connections in Three-Phase Systems. WALTENHOFEN. *Zeit. f. Elek.*, Dec. 1.—Those who for the first time read descriptions of the connections in the three-phase system, are apt to be misled to believe that there is something essentially new and different from the usual systems, and this is apt to make one believe that it is difficult to understand the whole subject. The object of the present article is to show that this system is nothing more than a simplified combination of three ordinary single-phase circuits. In a diagram he shows three simple single-phase circuits entirely independent of each other, each with its generator and transformer. If three equal currents of the same frequency and shifted in phase relatively to each other by one third of a period, be passed through these circuits, there will be no difference of potential between the end of one circuit and the beginning of the next, and therefore if these ends are connected no current will flow from one to the other, from which it follows that the two leads from those two points may be replaced by a single one without introducing any new principles or changing in any way the circulation of the currents in the system; the same applies to the other two pairs of terminals; the 6 leads of the independent circuits may therefore be replaced by 3; each lead may if desired be considered as a double wire. Similar argument is applied to the star form of connection; the first shows three independent circuits, and then states that if the currents are equal, have the same frequency, and differ from each other by one third of a phase, then the three wires which represent one end of each of the circuits may be combined into one without changing anything, and there will furthermore be no current in this lead, showing that it can be omitted entirely.

Operating Meters for Different Rates of Charging. RASCH. *L'Ind. Elec.* Dec. 10.—A description in French, of the same system which was abstracted in the *Digest*, Dec. 14, from the German.

Central Stations. Lond. *Elec. Rev.*, Dec. 13.—Brief, illustrated description of the Salford 3000-volt alternating-current station, and the Windemere water-driven plant; the latter has been in existence nearly two years and has been very successful, having succeeded in paying a dividend of 6 per cent.; a feature of special interest is the lighting of the streets and highways by means of incandescent lamps by the Brush series system; the lamps are arranged in groups of 20 across a constant potential circuit of 2000 volts, each globe contains 2 lamps, one being a reserve in case the other breaks.

Edinburgh. Lond. *Elec.*, Dec. 13; editorial.—After only 7.5 months working of this station the economy of production has been so remarkable that with only 285,000 kw-hours sold up to date the cost at the station, including the office expenses, amounts to only 3.12 cents per kw-hour, the greater portion of the period covered being in the summer. Prof. Kennedy considers this quite a record and believes that in the first completed year the cost of operation will be reduced to 3.0 cents, and that the company will have a credit balance of $10,000 to $15,000, after paying every charge, including interest and sinking fund. He recommends using 200 volt lamps in the future. The proposed extensions are described in a report published in the Lond. *Elec. Rev.* and *Elec. Eng.*, Dec. 13.

Paris. Lond. *Engineering*, Dec. 13; editorial.—A discussion of some length on the relations of the Paris municipality to the electric installations. The municipality has recently arrived at certain decisions with reference to the control of electric power-stations in Paris and the distribution of the current.

Paris. LAFFARGUE and MEYER. *Bul. Soc. Int.*; November.—A reprint in full of the papers noticed in the *Digest*, Dec. 7.

Interlaken. PRELLER. Lond. *Engineering*, Dec. 13.—Well-illustrated description of a 600-hp single-phase alternating-current installation driven by water-power.

WIRES, WIRING AND CONDUITS.

Calculating Electric Leads. HEUBACH. *Elek. Zeit.*, Dec. 12.—He points out some false impressions existing in the methods for the calculation of leads, and describes a better way of computing them. The general method is either to assume a certain current density, and then to find whether the total loss of voltage is within the limit, or, what in principle is the same, the cross-section is taken so that the loss of voltage, per unit of length, is constant throughout the network; the results obtained in this way are always within the heating limit; it is often supposed, however, that this method gives the minimum amount of copper for the given drop, some books even give this as the proper method. He gives a general discussion of the factors which enter, and shows how the results compare with those for the minimum amount of copper; from simple algebraical deductions he shows that the watt-losses per unit of length are proportional to the cross-sections, that is, to the currents, and the total watt-losses for the whole length of the line are proportional to the weights; this is based on the usual methods; that this does not comply with the conditions, which give the minimum amount of metal, is shown by a numerical example from which he deduces the rule that in a lead in which different parts carry different currents, a more favorable weight of copper would be obtained if the wires of larger cross-section had a greater current density than the smaller ones. To deduce general formulas for the minimum amount of metal he considers it best to assume a given quantity of copper, and then to find what the various cross-sections must be in order to obtain with this quantity of copper the smallest drop; this he does analytically and graphically, from which he finds that the drop per unit of length, as also the current density, are proportional to the cross-sections of the different parts of the leads; that the currents are proportional to the square of the cross-sections, and the cross-sections are proportional to the square roots of the currents; that equal weights of copper have equal drops; that the watt-losses per unit of length are proportional to the cubes of the cross-sections; that the total watt-losses in the separate leads are proportional to the product of the cubes of the cross-sections of those leads and their lengths. The first conclusion gives the impression that the method cannot be applied practically, for on account of heating the larger cross-sections should have smaller current densities, while the conclusion above given requires that the current density is proportional to the cross-section; the method would therefore be inapplicable if it were applied to leads in which the cross-section with respect to heating, rather than the loss of volts, is the important factor, a case which occurs very seldom in practice; to be sure that in all the results obtained by this method the heating limit is not surpassed, it is only necessary to find whether in the largest wire of the network, this heating limit is not reached; if the cross-section of the largest lead is safe against heating, then all the smaller wires may be depended upon as being safe. A numerical example is worked out and it is shown that the old and the new method gave 75.15 as against 66.67 kg of copper, or a difference of 13 per cent.; he has worked out a large number of practical cases and found on an average a difference of 10 per cent. in the saving of copper; considering the very large amounts of money invested in the copper, the commercial value of the use of this method is evident, notwithstanding that the formulas are not so easily applied.

Conductor Materials. PERRINE. *Elec. Eng'ing*, Dec. 1; continuation, see *Digest*, Dec. 7.—He describes the method of Feldmann for calculating the size of fuse wires; he found that the fusing current was equal to a constant, representing the current required for fusing a wire of unit length and unit diameter, multiplied by a certain factor, the values of which are given in a table of curves and which is a function of the length and diameter; he states that according to the best authorities there is no difference between a direct and an alternating current in the amount necessary to fuse a wire; he discusses the ageing of fuse wires, claiming that it is an undoubted fact that fuses are subject to variations, and that therefore the fusing current is a function of the time. The only reliable remedy seems to be a systematic replenishment of the fuses, whether they have been blown or not; to provide against sudden short circuits

he thinks the magnetic circuit-breaker is better, the fuse being adapted more to slow increases of current.

Manufacture of Wire. Perrine. *Elec. Eng'ing*, December.—First part of an article on the subject.

ELECTRO-PHYSICS AND MAGNETISM.

Dielectric Constants of Gases. Lanf. Lond. *Elec.*, Dec. 13; abstracted from *Wied. Ann.* No. 11.—He discovered a simple law; the specific inductive capacity K of a gas is determined by its valency; if s is the sum of the valencies of the atoms composing the gaseous molecules, then $K-1$ divided by s is a constant, equal to 123×10^{-6} for all gases at normal temperature and pressure; the quantity $K-1$, which is called the electrification number, represents that portion of the electrostatic strain which is due to the presence of matter. Hydrogen, being removed from its critical temperature, occupies a slightly anomalous position. Mr. Linde in the same number discusses the validity of the Clausius-Mossotte formula for the specific inductive capacities of liquefied gases and of vaseline oil, benzol and toluol oil.

Circular Magnetization. Klemencie. Lond. *Elec.*, Dec. 13; abstracted from the *Wied. Ann.* No. 11.—Circular magnetization of iron wires through which a strong current passes, gives rise to strong extra currents from which the magnetic susceptibility may be calculated; in soft iron the circular is smaller than the axial susceptibility; hardening the wire by drawing makes the latter decrease more quickly than the former; in Bessemer steel the circular considerably exceeds the axial susceptibility.

Alternating Currents. Shepardson. *Elec. Ind.*, December.—Continuation of his popular series of articles; the present is devoted to transformers.

Complex Quantities in Alternating-Current Work Dommerque. *Elec. Eng'ing*, December.—Continuation of his long serial; he discusses circular hyperbolic functions.

Action of a Current in an Aluminum Wire. West. Elec., Dec. 28.—A reprint of the illustrations of the article abstracted in the *Digest*, Sept. 7.

ELECTRO-CHEMISTRY AND BATTERIES.

Bleaching Liquid. Engelhardt. *Electrochem. Zeit.*, December.—Although the process of electrolyzing salt to form bleaching liquids has been known publicly for 15 years the progress has been slow, which he says is due to the difficulties involved, more especially to the fact that owing to the chemical properties of the final products, it is very difficult to make simple and practical apparatus which is not subject to great deterioration, also to obtain a good efficiency. He points out the difficulties in the construction of a suitable anode, and describes the one of Kellner, which is called the "point" electrode, and seems to consist of a number of platinum points in a hard rubber plate resembling a brush, which is said to allow a great current density with a small weight of platinum; he described briefly the application; it appears that the temperature of the liquid is raised, necessitating leading the liquid out to be cooled and then back into the tank; the proportion of active chlorine reaches 0.05 per cent. every time it passes through the tank. It is not economical to increase the amount of chlorine above 1 per cent., which solution is used directly for the bleaching. He gives a table showing how the bleaching power of this liquid, as also one of chloride of calcium, diminishes in the light and in the dark from 1 to 25 days, from which it appears that the bleaching liquid is not decomposed as rapidly as the chloride of calcium solution in the light, while in the dark they are both about equal. It is said to be well known that both liquids, containing equal amounts of active chlorine, bleach equally well. One of the advantages of the electrolytic products is that it is easier to wash the products and there is no necessity of using acids with the electrolytic process. He gives at some length the results of Mr. Agloblin to determine the bleaching action with a number of different coloring materials. He found that vegetable dyes and those belonging to the red aniline group are in general bleached very readily, while aniline black and indigo are more difficult to bleach. One of the most valuable results of the experiments was to show that the fibres of the fabric were not injured in the least, while with the ordinary bleaching process this is not the case. He summarizes the advantages of electrolytic bleaching as follows: There is no need of using acids in the process, a simple washing being sufficient; the price of chloride of calcium will probably become greater in the future, and he believes that it will be cheaper in many factories, where power is reasonably cheap, to use the electrolytic method even at the present price of chloride of calcium; the longer opened barrels of chloride of calcium are in use the more chlorine will they lose, while with the electric process the solution has always the same strength; bleaching takes place better by placing the fabrics in the electrolytic solution, while with chloride of calcium the fabric is saturated and then dried in the air. He gives an estimate of the cost of production for a factory in which 900 kg of chloride of calcium are used per day of 24 hours: The power required will be about 100 hp; the first cost of the installation, $4000; the cost of power per day if obtained from water-power, $7.78; and if steam-power, $14; the cost of the chloride of calcium will be at least $18; this shows that there will be a saving even if steam-power is used.

Chlorine and Soda. Knorre and Pueckert. *Zeit. f. Electrochem.*, Nov. 20.—A description of their recent German patent. In the electrolysis of hydrochloric acid, chlorine gas will be developed at the anode only when the solution contains 23 per cent. of the acid; with more dilute solutions there is always a mixture of chlorine and oxygen developed; they consider that it would be of great value if it were possible to electrolyze a weak solution with strong currents. If a salt solution is electrolyzed without a diaphragm there will always be a formation of hypochloride at the anode, and only a part of the chlorine will be set free; they consider that the production of chlorine, by electrolysis of salt solutions, without a diaphragm, is as unsatisfactory as the electrolysis of weak hydrochloric acid. If 7 per cent. of hydrochloric acid is dissolved in one liter of water (?) and electrolyzed, 98 per cent. of the theoretical quantity of chlorine will be generated, and this will diminish gradually to 85 per cent.; the process is carried on until the liquid, after electrolysis, still contains some free acid, and the original proportion of chloride of sodium will then remain the same; (although the description is not very clear, it appears that they use a mixture of salt and hydrochloric); the quantity of free chlorine is then as great as with the electrolysis of concentrated salt; in place of the salt other metallic chlorides can be used; the process depends on the intermediate operation of the formation of hypochloride, and the action of the hydrochloric acid on it.

Alkaline Chlorates. Zeit. f. Electrochem., Dec. 5.—A description of a process patented by the Schuckert Company.—Moderately concentrated solutions of an alkaline chloride are electrolyzed at a temperature of 40 to 100 degrees C. and a current density of 500 to 1000 amperes per sq. m in baths containing no diaphragm; to prevent the formation of free alkaline hydrates, which are so injurious to the carbon anode, the electrolyte contains an addition of 1 to 5 per cent. of an alkaline carbonate; free alkaline hydrates take part in the electrolysis to a greater extent than the chlorides, carbonates or bicarbonates; to decompose as much chloride as possible for a given current density, the amount of the carbonate must be kept as small as possible; in place of the carbonates, organic compounds may be used, whose oxidation at the anode generates carbonic acid gas; the process is stopped as soon as the consumption of current, relatively to the formation of the chlorate, becomes too great; the solution is then drawn off and the largest part of the potassium chlorate will then crystallize out, the remaining liquor being again passed through the apparatus.

Ozone. Tindall *process. Zeit. f. Electrochem.*, Dec. 5.—Brief, illustrated description of his patent.—He claims that with the ordinary apparatus it is not possible to increase the quantity of ozone above a certain amount, with relatively the same expenditure of energy; he claims that the concentration depends on the time during which the gases are subject to discharge, on the intensity, on the distances which the gases pass through the field and on the temperature; with his apparatus the rise of temperature is kept as low as possible in order to produce a more concentrated product; the gases are passed successively through an ozone generator, then through a cooling apparatus, then through another generator and cooling apparatus, etc.; he claims that this is quite different from an apparatus intended for cooling the poles only; in series with the discharge he uses water resistances which, besides being constant hav the advantage of preventing the formation of sparks in the discharge tubes.

Secondary Phenomena in Electrolysis and Their Importance in Practice. Bein. *Electrochem. Zeit.* December.—The first portion of what appears to be a long article in the nature of a treatise on the subject; in the present portion he discusses in general the primary processes, limiting himself to solutions as distinguished from fused salts; also the chemical changes at the electrodes, under the heading of secondary reactions.

Theories of Electrolysis. Whethan. Lond. *Elec.*, Dec. 13; abstracted briefly from *Science Progress.*—He summarizes existing theories of electrolysis.

Electrometallurgy. Borchers. *Zeit. f. Electrochem.*, Dec. 5.—He gives a full-plate table containing a list of all the metals and the various different metallurgical processes, showing by means of cross-hatched spaces which of the various processes may be carried out with the aid of electricity and which are carried out by purely chemical processes; the chemical processes outnumber the electrical; for a number of the metals there are several different electrical processes, the only metal for which there is no electric process is mercury; the comparison is merely qualitative, as he states that there is not sufficient data to make the much more interesting quantitative comparison.

Plating Aluminum. Legate *process. Zeit. f. Electrochem.*, Nov. 20.—brief description of the English patent. Articles are first treated in a bath of dilute sulphuric and boric acids, then dipped in a solution of caustic soda at about 45° C., then washed in water; after this they are dipped in a pickle consisting of sulphuric acid, nitrate of soda, hydrochloric acid and lampblack; after being washed they are then placed in a bath of ammonia containing cyanide of calcium, chloride of zinc, potash and arsenic, at a temperature of 28°; the pores of the metal are then closed by immersing the articles in a bath of water, ammonia, cyanide of calcium, soda, copper chloride and arsenic; after this they may be plated in the regular baths with the different metals. The proportions of the preparing baths are given.

Blot Accumulator. VALLS and MARGAINE. *L'Ind. Elec.*, Dec. 10.—The former criticises the article of the latter, which was abstracted in the *Digest* last week. He claims that it creates a wrong opinion of the value of the Faure accumulator. The statement which Faure made referred to his original type of plates in which the active material was merely held on the surface of the plates by means of some fabric. This type of plate was abandoned 13 years ago, and he considers that it ought not to be cited now for making a comparison between that type of cell and the one described by Margaine; the improvements made in this type of cell renders the argument of Margaine inapplicable. As to this new accumulator, he considers it quite similar to that of Kabath, invented in 1882. In reply Mr. Margaine claims that what Faure found to be the case in 1882 is still true to-day, and he considers that it is not right to overlook the history of accumulators in such a comparison. He considers that his argument regarding the heterogeneous character of the plates formed of oxides shows the superiority of those of the Plantè type. He believes that there is only a vague resemblance of the Blot cell with that of Kabath, and to show that the former is different he states that the German and United States Patent Offices after a careful examination have granted a patent for it.

Primary Battery. Der Techniker, December.—One pole consists of a carbon plate in dilute sulphuric acid, which is saturated, while cold, with potassium bichromate, and kept saturated by keeping crystals of salt in the solution; the other pole is amalgamated zinc contained in a porous cup filled with concentrated sodium lye, which cup is placed in another containing a solution of sodium lye of a specific gravity of 1.05; the internal resistance is 0.8, and the voltage at starting 2.5; after 10 hours' continuous service it was 2.4; if every three hours, 40 cm of the lye is drawn off and replaced by a fresh solution, it is stated that the current can be kept constant almost continuously.

Copper Refining by Electricity. GARNEAU. *Elec. Age*, Dec. 14; a reprint from the *Yale Sc. Monthly*.—A brief description of the process used in this country for the refining of copper and the treatment of the gold and silver which is separated out during the process.

Electro-Metallurgy of Zinc. West Elec., Dec. 28. A reprint of the illustrations of the article abstracted in the *Digest*, Dec. 14.

Electro-Deposition of Gold. ANDREOLI. *Eng. & Min. Jour.*, Dec. 21.—A condensed reprint of the article abstracted in the *Digest*, Dec. 14.

UNITS, MEASUREMENTS AND INSTRUMENTS.

D'Arsonval Galvanometer. Lond. *Elec.*, *Elec. Rev.* and *Elec. Eng.*, Dec. 13.—An illustrated description of the CROMPTON form. The magnets are of a horseshoe shape, and the poles are drawn out to a short edge, immediately opposite the coil, which is in the form of a ring; the suspension is bifilar; the distance between the two suspension wires at the top may be increased or diminished by means of a thin strip of insulating material carried by an arm which is either moved vertically or turned on its axis; thus by turning this and thereby altering the distance between the threads, or by raising or lowering it, both the sensibility and the period may be adjusted to requirements. Great care is taken to have the copper and its insulation free from magnetic particles; a coil is easily removed and another one substituted; several coils are supplied with each instrument, and they weigh from 6 to 10 grammes, having a resistance of 50 to 1500 ohms. Ordinarily the deflection is 10 scale divisions at a distance of 2900 scale divisions, with the terminals connected to a shunt of one one-hundredth of an ohm in series with 20,000 ohms and a secondary cell, thus corresponding to a voltage of one millionth of a volt, the resistance of the coil and its suspension being about 1500 ohms.

Photometric Method Which is Independent of Color. ROOD. *Prog. Age.* Dec. 16; reprinted from the *Amer. Jour. of Sc.*—He describes a method in which the coloring of the surfaces illuminated is a matter of entire indifference; the method does not depend on a comparison of these surfaces, but on the shock which the retina experiences when one surface is quickly withdrawn and replaced by another. If a uniform disc is rotated the retina will receive no shock, but if one half of the disc reflects less light than the other, by one fiftieth of the total amount, with appropriate rates of rotation, a faint flickering will be noticed which will increase in intensity as the difference of luminosity becomes greater. He describes experiments made with about 100 discs of various tints from white to black, with an even gradation; for determining the reflective power of a vermilion disc, for instance, "it was only necessary to select from the series a gray disc, which, when combined with it in equal parts, gave no perceptible flicker, and afterward to determine the reflecting power of this gray disc in terms of the standard white cardboard." For measuring the reflective power of color discs, it is not always necessary to make an elaborate set of gray discs. If the reflecting power has been carefully determined for six or eight colored discs, then with black and white ones it is possible to match new discs and measure their luminosity in the old way. He sees no reason why this process could not be applied to ordinary photometric work; the steps in the gradation may be overcome by regulating the illumination; the sensation called flickering, he says, is independent of the wave length and connected only with change in luminosity; when two differently colored surfaces of the same luminosity are successively present to the eye, as described, no shock is experienced. (The description of the method is not entirely clear.)

Photometry. Prog. Age, Dec. 16.—A number of articles which have been noticed before, and of interest chiefly to gas engineers.

STINE. *Elec. Ind.*, December.—A continuation of his popular series of articles; he describes a simple photometer and the way to use it.

Practical Testing. HASKINS. *Elec. Ind.*, December.—Continuation of his popular series of articles; the present is devoted to the tangent and the sine galvanometer.

Avoiding Surface Leakage in Insulation Tests. PRICE. *Elec. Eng.*, Dec. 28.—A reprint of the article which was noticed in the *Digest* last week.

TELEGRAPHY, TELEPHONY AND SIGNALS.

Synchronous Clocks. HOPE-JONES and BONELL. Lond. *Lightning*, Nov. 28.—They describe, with the aid of illustrations, a system of municipal synchronous clocks. The master clock consists simply of a pendulum escapement which is driven by a small weight, re-wound automatically every 15 seconds by means of an electromagnet, whose circuit is closed when the weight has descended. The driving weight consists simply of a spur-wheel, half of which is solid and the other half open, the solid part acting as the weight, the spur-wheel driving a pinion on the escapement; each pendulum controls a large number of dials; each sub-station is the centre of a group of 25 dials; a diagram of the connections is given; at three minutes before each hour each sub-station puts its synchronizing apparatus on the line circuit, so that an hourly synchronizing-current may be sent from headquarters to all the stations.

Communication Between Moving Trains. DE LA TOUCHE. Lond. *Elec. Rev.*, Dec. 13; abstracted from a French journal.—It is a system for communicating between one train and another on the same track; the two rails are insulated from each other and the joints are electrically bonded; the locomotive contains a small 2-hp dynamo driven from the axle, and a set of accumulators which send a current to the rails; this is intended to actuate certain apparatus in near trains, whether going in the same or in opposite directions; it appears that three galvanometers are used in the circuit, and that the driver can at any moment see whether there is a train near, and if so, how far it is off; it seems that no practical test has been made (it is not explained why the wheels do not short circuit the tracks).

Signals for Crossings. LANGBEIN'S *System. Zeit. f. Elek.*, Dec. 1.—An illustrated description of this system for automatically ringing an alarm bell at railway crossings; it is claimed to be much simpler than the usual systems; the approaching train starts an alarm and stops it after it has passed the crossing.

Amazon Cable. Lond. *Elec. Eng.*, Dec. 13.—A brief description, with a map, of this cable, which is being laid. The extremely rapid growth of vegetation in Brazil renders the maintenance of overhead wires very costly, and therefore the present cable is to be run along the bed of the Amazon River to connect Para with Manaos, as also 14 towns on the river.

New French Atlantic Cable. Lond. *Elec.*, Dec. 13.—An abstract of the agreement which has been entered into between the French Government and the French Cable Company regarding the proposed new cable from Brest to Cape Cod.

Size of Telephone Central-Stations. Elek Zeit., Dec. 12, editorial.—Referring to the recent article of Mr. Hultmann (*Digest*, Dec. 7) an additional argument supporting his views is given. In his discussion, as well as in that of Mr. Landrath, on Telephony in Berlin (*Digest*, Dec. 28), it was assumed that the network of wires forms an independent unit; but this is no longer the case, considering that interurban telephony is coming into use more and more every day, and if this is taken into consideration a new feature is introduced, which outweighs a number of the other considerations. As long as it concerns very short distances, it is not of much importance whether an additional station is inserting in the circuits, as the transmitters and receivers are not affected materially thereby; but if the transmission is over great distances, which taxes the apparatus to its utmost, it is very important to exclude as much as possible all factors which have an unfavorable action on the transmission. It is thought that in the near future long-distance transmission will be of greater importance, and will have a greater scope than that of urban transmission. The factors which affect the transmission unfavorably are the various apparatus in the station having self-induction and capacity and for long-distances transmission it is therefore of great importance to have, as far as possible, for every city only one central station. The economy in the operation of the system will suffer somewhat, but this should not stand in the way in the construction of a first-class station. The important question is not one of economy but a proper consideration of the most effective system and the greatest security in operation.

Telephony in Iceland and the Desert of Sahara. Elek. Zeit., Dec. 12.—Various towns of the island are to be connected by telephone, the plant being installed by an American company. It is thought that it will not be long before the island will be connected with Europe by telegraph by way of the Shetland Islands, the cost being borne partly by England, France and the United States, which countries take part in the fishing and are also interested in obtaining weather reports from the island. A

line was recently installed from Biskra to Tuggurth, in the Desert of Sahara.

Charging Storage Cells for Signalling Purposes. Hubbard. *Elec. Eng.* Dec. 18.—A description of an automatic switch used for charging a series of storage batteries; the batteries are arranged in two sets, one being charged while the other is discharged; in order not to depend on an attendant, the switch was designed to disconnect one set and connect the other with the dynamo, whenever the dynamo was started and stopped. There are two switches, one above the other, the upper one being the pole changer which is operated by the lower one which breaks the connection between the dynamo and batteries when the voltage of the former drops below the proper point; when the voltage of the dynamo has reached the proper amount, a magnet is energized, closing the charging circuit, while when the voltage falls the lower switch lever returns to its position of rest and in doing so it reverses the upper switch, thereby reversing the connections.

Automatic Switch Indicators. Salmon. *Eng. News*, Dec. 19.—A reprint of a recent paper describing briefly a number of different systems in use.

Type Printing Telegraph. Carbaugh. *Elec. Eng.*, Dec. 18.—Abstract of a brief, illustrated description of tests made in the War Department with the Essick instrument, for transmitting signals in artillery practice; it prints messages on a sheet of paper five inches wide and is operated like a typewriter; it appears that only one line wire is used, although there is no definite statement to that effect; a dynamo is used to generate the current which is about 0.25 amperes; no description of the instrument is given other than the illustration; it seems to have worked satisfactorily, except that lightning interfered with the permanent magnets.

Telephony. Wietlisbach. *Elec. Eng'ing.* December, continuation.—He discusses protective devices and the earth wire.

Cable Repair Steamer. Sc. Amer., Dec. 28.—A well-illustrated description of the steamer "Mackay-Bennett," and of the method of splicing the cable.

Switchboard Testing. Finn. *Teleg. Age*, Dec. 16.—A continuation of his serial describing tests for telegraph and telephone lines.

MISCELLANEOUS.

Water Pipes and Lightning. Hondry. Lond. *Elec.*, Dec 13; abstracted from *Genie Civil.*—He describes a curious case of damage to water pipes, which was caused by lightning. On a certain day the water supply in a suburb of Havre was cut off, and it was found to be due to a leak caused by a number of lengths of pipe being split open. On examination it was found that the pipe was completely perforated at the spot where the root of a tree was just touching it. On the same day that tree was struck by lightning. From this point, for a distance of almost 270 feet, almost every length of pipe was split longitudinally. In laying water-pipes, he recommends keeping as far away from trees as possible.

Electricity in the Paper Industry. Hellrigl. *Zeit. f. Elek.*, Dec. 1.—An article chiefly on the paper industry and referring briefly to the process of Kellner by means of which wood pulp is said to be produced in a simple and cheap way with the aid of an electric current; it is said to be in use by three large factories, one in England, one in Norway and one at Hallein, Austria, where salt can be obtained cheaply, and is claimed to have been successful; the process however is not described; the article refers more at length to the bleaching of wood pulp by means of bleaching liquid made by electrolyzing a solution of salt and which is said to have a less deleterious effect on the fibres.

Birmingham Technical School. Lond. *Elec.*, Dec. 13; illustrated description.—It is a municipal school which has just been opened, and is said to be one of the finest of the new institutions in that country; it is devoted to instruction in the arts peculiar to that locality and to the fundamental principles of the allied sciences; its cost was only $420,000, notwithstanding the fact that Prof. Thurston (of Cornell University) stated that it was impossible to start an institution of this kind with less than one million dollars.

Static Electricity Applied in Bottle Labeling. West. Elec., Dec. 28.—An illustrated description of a machine used for labeling bottles, in which static electricity is used to detach the top label from a pile, so that it may be subjected to the action of a paste roller and afterwards attached to a bottle. The description says that an ordinary glass friction machine is used, but the illustrations show an influence machine. It is stated that the label is "lifted from the pile by means of a static electric current" (*sic*). The description is limited almost entirely to that of the mechanism of the machine, very little being said about the electric apparatus. It is said to be capable of running at the rate of 60 labels per minute.

MacEvoy Submarine Explorer. West. Elec., Dec. 28.—A reprint of the illustrations of the article abstracted in the *Digest*, June 22.

The Digest for 1895. During the past year the number of journals abstracted in this department was 1859, averaging about 36 per issue; of these 1121 were foreign and 738 American. The number of abstracts and references was 3701, averaging over 71 per week; the largest number under one heading was 622 under Traction; Electro-Physics and Magnetism comes next with 461, and Electro-Chemistry and Batteries next with 411.

New Books.

The Electrical Transmission of Energy. By Arthur Vaughan Abbott, C. E. New York: D. Van Nostrand & Co. 586 pages 9, folding plates, 74 tables and many illustrations. Price, $4.50.

The details of the general systems of electrical distribution have been in such a transitory state since the application of electricity to industrial purposes, that it has been a difficult task to write a book classifying logically the various elements entering into the systems. Mr. Abbott has in this work compiled a vast amount of detailed information regarding the best systems of overhead and underground work, and arranged it in such a form as to be easily understood by the practical constructor, and at the same time given sufficient mathematical demonstrations of the main principles involved, to make the book interesting and valuable to the mathematician. There is probably no other book published at present which contains so much of practical value to the man who is engaged in the construction of transmission lines, for the reason that not only are the principles and mathematical computations given of most subjects of which the book treats, but tables of sizes and strains, etc., and bills of material of many of the parts which enter into the construction of overhead lines are given. The book is divided into 12 chapters, in which are treated the subjects of general distribution, the properties of wire, construction of aerial circuits, the construction of underground circuits, instruments, measurements, continuous-current conductors, conductors for alternating currents, series-distribution, parallel distribution, miscellaneous methods and long-distance transmission, and the cost of producing and distributing electrical energy. Each chapter is sub-divided and much carefully compiled information is given, especially in the chapters relating to aerial circuits, electrical testing, and on the cost of producing and distributing electricity. If any general criticism could be offered, it would be one which would question the author's idea of attempting to cover too wide a field within the limits of one book, as the chapter on the cost of producing and distributing electrical energy belongs more properly outside the domain of this book. But what he *has* done he has done *well*, and although many subjects which might have been treated more fully have been abridged, it is undoubtedly due to the attempt to confine the substance of the book within reasonable limits. On the whole, this work is a valuable contribution to present electrical literature, and one which should find its place in the hands of electrical engineers and constructors in general.

The "Practical Engineer" Pocket Book and Diary for 1896. By William H. Fowler. Manchester, England: Technical Publishing Company, Ltd. 371 pages. Price, $1.

A "Pocket Book" to be at all valuable, must present its data in an accurate, concise and clean-cut manner; otherwise it is worthless, for there is no middle ground. Unless the seeker for information can refer to any statement or table in the book without the necessity of proving its correctness, he cannot afford to refer to it at all.

For lack of these essential qualities, if for no others, the "Practical Engineer" Pocket Book will fail of recognition as a valuable reference book, for we find it, in many instances, incorrect in statement, loose in phraseology and obscure in description.

It also contains a considerable mass of information of doubtful accuracy, seemingly compiled from trade catalogues, which has no legitimate function in a "Pocket Book," while the greater portion of that which appears to have some value, if culled out, illustrates only English practice and is therefore unavailable for American readers.

Its principal claims to recognition seem to be that it "contains upward of 400 pages," consisting "of a collection of valuable and original rules, tables," etc.; that there "is an additional section of upward of 50 pages of simple and compact notes on electrical engineering;" and that the "data specially prepared" "is absolutely unique in quality and price."

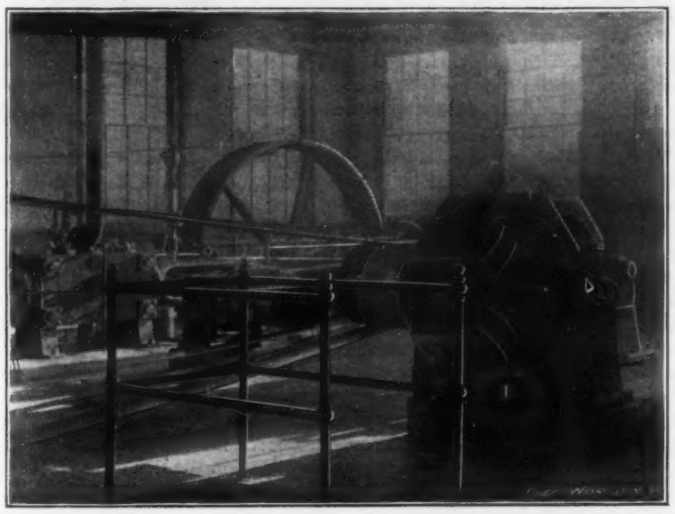
The "upward of 400 pages" are more accurately 404, of which nearly one third are devoted to advertisements, index, preface, diary and blank pages for memoranda. The "section of upward of 50 pages of notes on electrical engineering" is valuable in so far as 50⅓ pages of definitions of the elementary units, descriptions of such apparatus as the Wheatstone bridge and the galvanometer and an A B C explanation of the transformer, with other information of a similar nature, can be said to be valuable when presented in so meagre and inadequate a manner.

That much of the data is "absolutely unique in quality" will not, at least by American readers, be gainsaid; in evidence of this a few examples have been selected at random: "A standard of 30 lbs. of water per hour, evaporated at 70-lb. pressure from water at 212 deg., was adopted by the judges at the Centennial Exhibition in America;" "in multitubular and other boilers, where the ratio of grate area to heating surface ranges from 1 to 30 to 1 to 40, 4½ sq. ft. of total heating surface are required per horse-power;" "for large compound condensing engines the total friction of mechanism is about 18 per cent. of the ihp," and, in speaking of land practice in steam piping, "for pressures up to 100 lbs. on the inch, cast iron is almost invariably used."

A Great Manufacturing Establishment.

A mammoth industrial enterprise and one closely allied to electrical industries was inaugurated at Bristol, Conn., last week, the opening ceremonies extending over three days. The new works of the Sessions Foundry Company, to which we refer, are the largest and most complete in this country, and it was planned that the opening should be in a correspondingly befitting manner.

Thursday evening was devoted to the employees, their wives and families, numbering upward of 1000, for whom had been provided refreshments, and music by Colt's Band, of Hartford. Friday, from 9 a. m. and throughout the entire day, a reception was given to the business public, and the works were inspected by at least 7000 visitors, representing particularly the important manufacturing and business



POWER GENERATORS.

interests of Connecticut, including his Excellency Governor Coffin and Charles P. Clark, president of the Consolidated Railway Company. Refreshments were served all through the day. On Saturday the general public were received.

Some idea of the magnitude of the works may be gained from the statement that three acres of floor space are covered. They are conveniently located about three quarters of a mile from the Bristol railway station, and are traversed by six spur-tracks which run from the New England road-switch and encircle the plant; a switch-engine owned by the company is kept constantly at work about the yard, thus rendering easy of transportation the raw material and finished products. The electric railway also stops directly at the works. In fact, convenience and readiness of access to the entire works are noticeable characteristics.

The group of buildings comprise a commodious office building, 50 x 80 feet, of granite, solidly built and architecturally attractive and with interior arrangements of much beauty and taste; the superintendent's office; a power-house, 50 x 100 feet, and a pattern building, 50 x 100 feet, in which is in every respect a model electrical plant and splendidly equipped; a machine shop, 60 x 80 feet, equipped for the easy and economical handling of the heaviest work; a shipping building, 80 x 300 feet, and the main building, in which is carried on the work of moulding and casting, and which is an immense fireproof structure of brick and iron, 530 feet long, 110 feet wide and 55 feet high in the centre, with a skylight 30 feet wide running along the entire length of the building, and with large and numerous windows along the sides. Light and ventilation are perfect. This immense building attracted particular attention. It is an enormous workshop, in which all the heavy castings will be made and handled by a huge electric crane with a lifting capacity of 25 tons. In this building will be done also the floor and bench work. As a matter of interest, it is worthy of mention that 760 tons of structural steel, two and one fourth million bricks and 400 tons of slate were used in the construction of these works.

The sanitary equipment throughout the works are of a most efficient character and every opportunity for the cleanliness and comfort of employees is afforded. The power-house is a model of completeness and beauty. Electricity is used throughout the entire plant for lighting and power purposes.

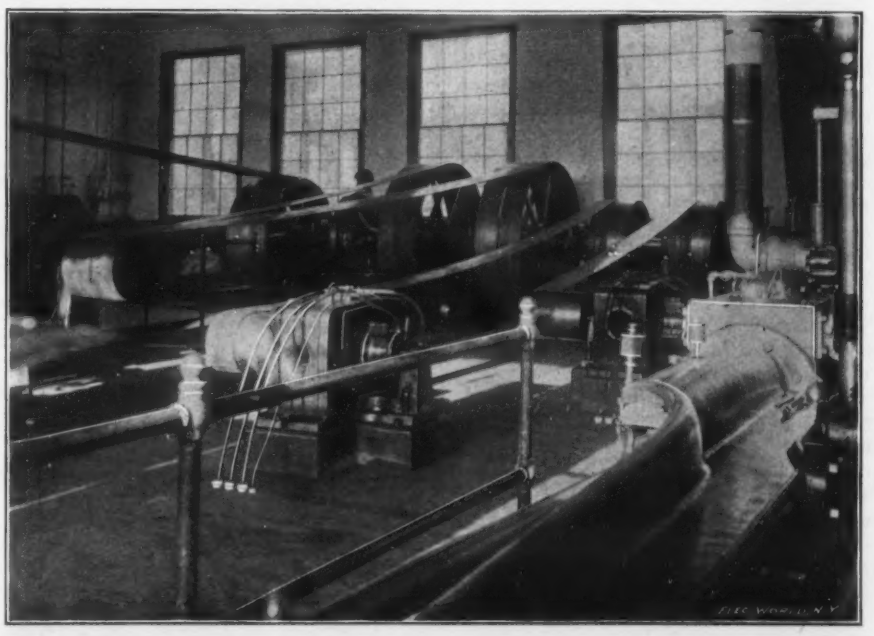
The Eddy Electric Manufacturing Company furnished the electric lighting and power apparatus, of which there are two 250-volt power generators of 220-volt 60 kw each, two 125-volt lighting generators of 20 kw each, six 220-volt motors of 25 hp each, one motor of 220 volts and 10 hp, and one motor of 220 volts and 3 hp. There are two engines of 200 and 100 hp respectively, made by the well-known W. A. Harris Engine Company of Providence, R. I. There are three Heine safety boilers of 150 hp each.

The electric plant is arranged in relay throughout, the two engines, each or both, being run from a counter-shaft. The two lighting dynamos and two power generators can be run separately or in multiple. The switchboard is so arranged that either lighting dynamo feeds any lighting main, and either generator feeds any of the power mains. There are also switches for controlling lights in the office and other departments, and provision for the possible addition later of a storage-battery plant for lighting when the power-station is shut down.

The wiring is so arranged that no more than two motors are placed upon a circuit, thus preventing accidents and delays. There will be in use 425 incandescent and 40 arc lights. The arcs and incandescents in the foundry have an independent circuit, and all light and power circuits are under the control of the foundry foreman, as he has a special switchboard for that purpose. The lights in the office are also fed by separate mains; also the pattern and storage buildings and shipping rooms, making in all a distributing system of 10 separate light and power circuits.

Ten and a half tons of Benedict wire were required; Okonite cables were used for generator connections. Hill knife-switches are used for all heavy work. The generator switchboards are from J. Grant High, of Philadelphia. Waterhouse-Gamble arc lamps are used. Hart & Hegeman's latest designs of flush switches are used exclusively in the office. Pass & Seymour furnished the porcelain tubes; Bradley & Hubbard the electric fixtures, and the Union Porcelain Works, the porcelain insulators. Weston instruments and automatic circuit-breakers are used, and all the work in the office is connected by brass-armored conduits from the Interior Conduit & Insulation Company. Mr. Timothy W. Sprague, of New York, is entitled to credit as consulting electrician in the construction of the plant, and Mr. George W. Fisk, president and general manager of the New Britain Electric Company, supervised the wiring and installation. Twenty-four telephones connect the various departments of the works, and pneumatic tubes are used for the transmission of orders.

A 20-hp engine runs the huge blower which forces hot and cold air to every part of the works. Messrs. Davis & Barnes, Philadelphia, Pa., who were the engineers and architects in the construction of the plant, were most heartily congratulated, and words of commendation were spoken for the Sturtevant Company, of Boston, who installed the heating apparatus; the National Pipe Bending Company, of New Haven, Conn., the feed-water heaters; the Eddy Electric Company, the electrical machinery; the Morgan Engineering Company, Alliance, O., the electric traveling cranes; the James Hunt Machine Works, North Adams, Mass., the shafting and pulleys; the Knowles Steam Pump Works, Boston office, the pumps; the Heine Safety Boiler Company, St. Louis, the boilers; the W. A. Harris Steam Engine; the United States Telephone Construction Company, Philadelphia, and in fact for all who participated in the construction.

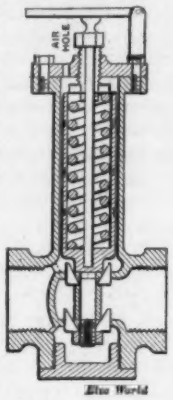


INCANDESCENT LIGHTING DYNAMOS.

As has been stated, the Sessions Foundry Company is closely allied to electrical industries. Its patrons have included, and still include, some of the most important electrical manufacturing companies, notably the General Electric Company, the Westinghouse Electric & Manufacturing Company, and the Eddy Electric Manufacturing Company. In fact, the electrical trade generally is well acquainted with its product.

Pressure Regulating Valve.

The valve illustrated herewith is the result of many years' experience in the manufacture of steam and pump regulating valves. It has already entered into considerable use, and the manufacturer, John Acton, 79 Washington Street, Brooklyn, states that satisfaction has been reported by users in every case. As will be seen, the regulation is controlled by means of a spiral spring within a cylindrical sleeve or hollow piston. The sleeve is of great length and contains several water grooves, which both lubricate the cylinder and act as packing against the escape of steam. The hole in the top of the case admits atmospheric pressure to the top of the valve. Owing to the very long bearing surface of the cylindrical sleeve and to the presence of the water pockets, no noticeable amount of steam escapes, a drip not being required in any case. When desired, a lever connection is made at the top to enable the valve to be moved at intervals of time when not in use, thus preventing any sticking, and to also enable the engineer at any time to assure himself that the valve is free to move. While experience has not demonstrated that this precaution is necessary, it is added to a valve when so ordered.



Acton Valve.

The Metropolitan Telephone System.

The New York telephone system has for some time past experienced a remarkably rapid increase of subscribers. Less than two years ago the number of stations did not exceed 10,000, of which about one-half were grounded circuit. At the present time the system contains some 13,500 stations, all, except a baker's dozen, having metallic circuits. Those who have read the daily papers may have noticed by the short intervals at which the figure in the Metropolitan Company announcements, representing the total number of subscribers, is changed 500 at a time, that the rate of increase has been substantially accelerated. This rapid growth is accounted for by the introduction, some 18 months ago, of the message rate system of charges, which results in a large reduction of rates to moderate users; second, by the systematic advertising which the Metropolitan Company has done during the past year, and by the excellent service and facilities which the company furnish to its customers.

The system is now practically exclusively metallic circuit. About six years ago the company had some 8000 grounded circuit subscribers; four years later this number had been reduced to about 5000. To induce this large number of subscribers to change over to the metallic circuit in so short a time has obviously entailed remarkably efficacious and persistent work, especially as the average man's appreciation of the whys and wherefores of telephone operation or any other electrical industry is not always as keen or as just as the technical manager might wish.

The Metropolitan Company now has, all things considered, the finest telephone plant in the world. With its wires practically all underground, even in many instances entering its subscribers' premises directly from the subways, with its lines and switchboards, metallic circuit throughout; with its more important exchanges equipped with the latest form of self-restoring drop-bridging switchboards, and installed in special fire-proof buildings, and with all its subscribers and public stations equipped with long-distance telephones, it has a system that for completeness, modernity and general high efficiency it is impossible to match among the other large telephone systems the world over.

The handling of the traffic has been kept well in step with the improvement in the plant and very careful attention is paid, by means of thorough supervision of the operating, to rapidity of service. This supervision is not confined to the operating rooms, but is extended to the subscriber ends of the lines by means of a corps of special service inspectors, who make test calls from subscribers' stations, timing each step of an operation with a stop-watch. A large number of these tests are made every month and the result tabulated so as to show, for the information of the management, the average efficiency of each exchange. The work of these inspectors also serves as a moral incentive to the operators, who may at any time be entertaining an angel unawares. The net result in any case is gratifying, as the average time of completing a connection, from the moment of the call to the moment the second subscriber has been got to the telephone, is about 30 seconds. Of this period, be it said, the "drag" of the subscriber accounts for the larger proportion, the actual operation of answering a call, making the required connection and beginning to ring the called subscriber occupying from eight to fifteen seconds (according to whether the connection be local or trunk), and the remaining time being taken up in getting the second subscriber to answer the call.

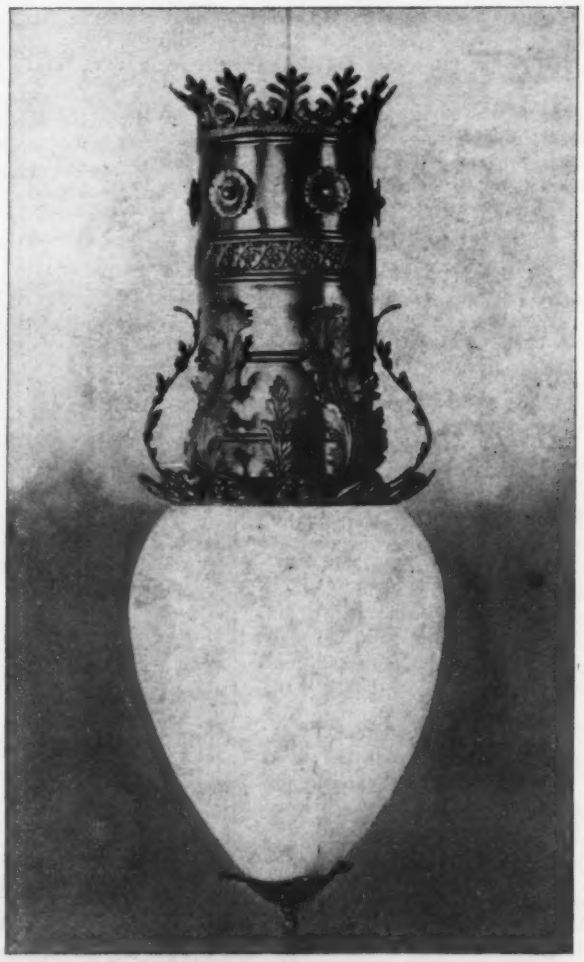
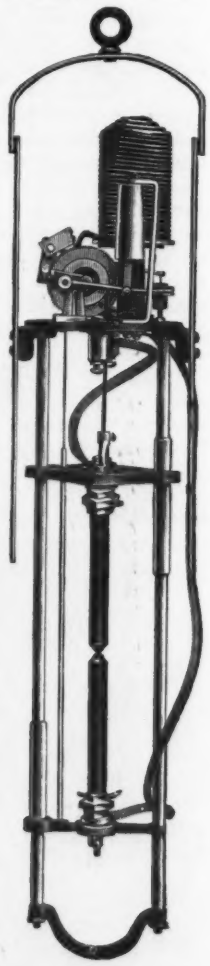
It has long been recognized by the officials of the Metropolitan Telephone Company that the subscribers can do much to improve the service for each other by operating their part of the system with due regard to a few practical rules, such as "holding the wire" after making a call, answering promptly, and so on, and constant effort is made to bring this home to all subscribers. Quite recently a little book bearing on this subject has been sent to each subscriber throughout the entire system. Such practical work as this is bound to have good results both for the company and for its subscribers.

A New Alternating-Current Arc Lamp.

It is only of comparatively recent date that attention has been directed toward the perfection of the alternating-current arc lamp, and among those who have been working along this line is the Fleming-Spence Electric Company, of 660 Hudson Street, New York, whose lamp we illustrate herewith.

As may be seen from the engraving of the lamp open, there are very few parts, and these are exceptionally strong and not liable to get out of order when subjected to the hard usage this class of apparatus usually receives. In operation, the regulation is effected by a solenoid with a laminated iron core. This core is connected to the long arm of a simplex lever by means of a spring device, thereby absorbing vibration and preventing noise. As the core is lifted up into the coil, carrying with it its end of the lever, the opposite end of the lever depresses a frame carrying a detent which engages the deep teeth on the periphery of the wheel mounted on the chain drum.

This detent, the motion of which is eccentric with that of both the frame and wheel, as it engages the wheel in its descent, turns it backward to a certain distance dependent on the quantity of current in the coil, thereby pulling the carbons apart and striking the arc. As the carbons burn away the core descends and allows the wheel to slip by, one tooth at a time, then readjusts itself to the new conditions instantly. This action is repeated continuously. The lamp will start instantly on its rated current and will maintain it almost absolutely constant. The carbon carriages are so designed that it is an impossibility for them to stick or bind, either from dirt accumulated on the rods or from their getting out of line. The hanger is made of spring steel and projects down the sides of the lamp far enough to allow the mouth of the globe to slip over it, thus making a very neat and effective globe holder. With an eye for beauty the manufacturers have produced from special designs a handsome line of ornamental lamps, one style of which is shown above.

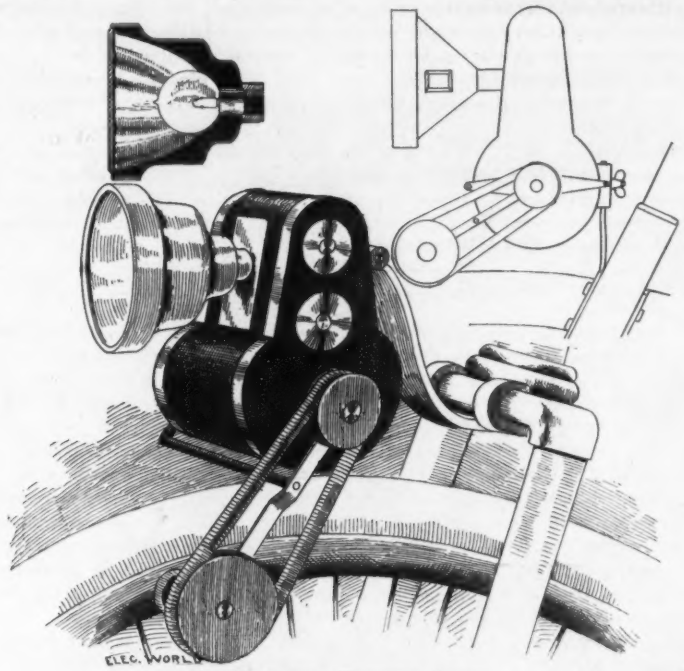


Ornamental Arc Lamp and Mechanism.

A valuable feature of these lamps is that the ornamental case can be transferred from one lamp to another, or in case a plain lamp is on hand, and an ornamental lamp is needed, it would only be necessary to order

an ornamental case of whatever style desired to fit the plain lamp. This is an important item for central station men, and avoids keeping a stock of lamps of different styles on hand.

An Electric Bicycle Lamp.

A unique bicycle lamp, which will soon be put upon the market and bids fair to be a very popular article, is illustrated herewith. A small magneto-electric machine, operated by a friction and band wheel, as shown, furnishes current for a miniature incandescent lamp. The little magneto has a shuttle armature, the core of which is thoroughly laminated. No

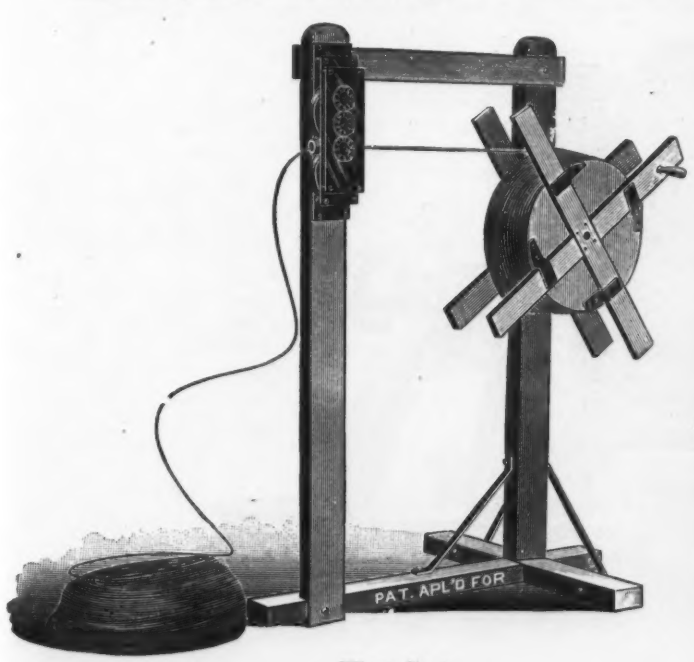


AN ELECTRIC BICYCLE LAMP.

commutator is used, but the current is collected from the frame of the machine, one terminal being grounded, and from one of the bearings which surrounds a slip ring on the shaft. Thus the construction is of the simplest. The alternating current is carried to a low-voltage, two-cp lamp, which is enclosed in a reflector of an ingenious pattern. It is a double parabola and concentrates the light at the focus of the outer parabola, from which it is thrown forward in a remarkably powerful beam, which will furnish illumination for quite a distance ahead. The slightest rotation of the bicycle wheel causes the lamp to glow. Indeed, it would be difficult to ride the wheel slowly enough to maintain equilibrium and not have light. The lamp has a short stumpy filament, and is therefore not liable to break from any cause except excessive current. The perfected model will admit of ready disconnection of the friction wheel from the tire, so as to render the magneto inoperative, and the transmission mechanism will have a dust shield.

A Wire Reel and Meter.

A simple and handy device for measuring wire has recently been placed on the market by the Minneapolis Electric & Construction Company, of Minneapolis, Minn. The accompanying illustration shows the meter and reel complete. The wire passes between two rollers, which automatically adjust themselves to any size of wire. The pointers are movable and readily adjusted to the zero point. The standard size of meter registers to 1000 feet, and will accurately measure either plain or insulated wire. In addition to this size, the company have already filled several orders for meters to measure rope, conduit and belting.

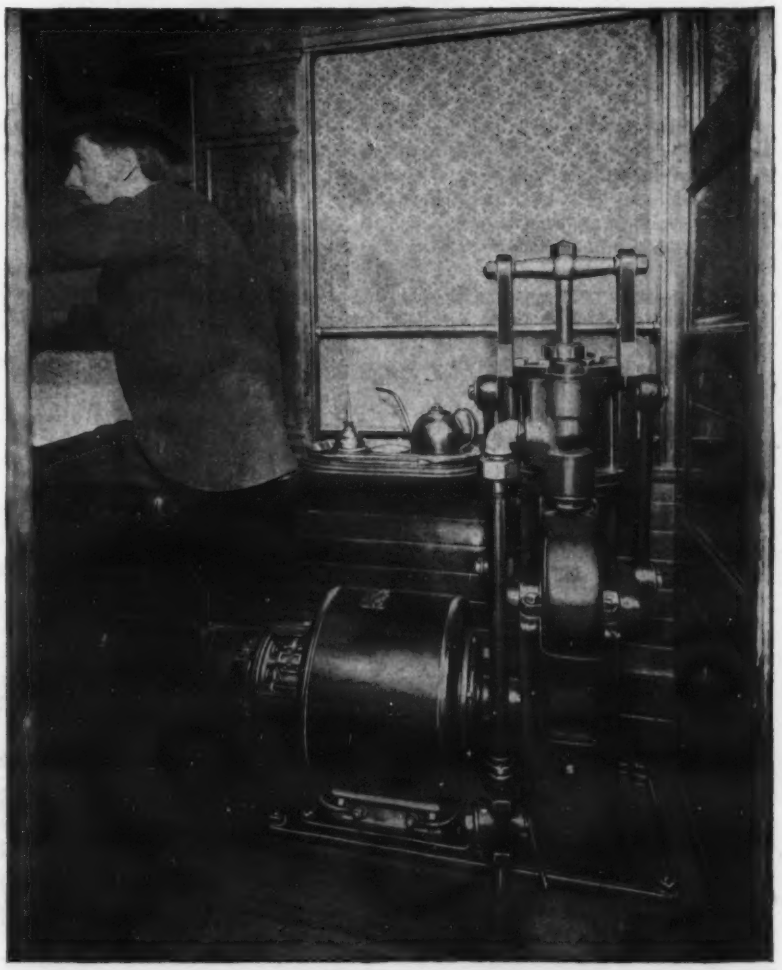


WIRE REEL.

Air-Brake Motors.

Without doubt, one of the finest equipments of its kind that can be found is that of the Metropolitan West Side Elevated Railway of Chicago, Ill. Elevated railways in many respects far exceed all other means of transportation within city limits, yet when operated by steam there are numerous features about them that are objectionable. Thus the public are quick to appreciate a road which is operated by electricity—where there are no flying cinders, no objectionable puffing locomotives, and no jerky, jumping motion sometimes felt the whole length of the train at every stroke of the piston on the engine; where the trains almost seem to glide in and out of the stations, and where the road is built between the blocks, so that the main streets are not disfigured and rendered dark, gloomy and disagreeable.

A very important feature in the smooth operation of a road lies in the system of braking. In this respect, as in several others, the equipment on the above system is second to none, and this one feature presents several points of interest. The air-compressors, which were furnished by the New York Air-Brake Company, are placed in the cab set apart for the use of the motorman. These compressors are operated by motors directly connected, and, as will be seen by the accompanying illustration, the equipment is very compact. The motors are completely enclosed, dust and moisture proof, and were furnished by the Storey Motor & Tool Company, of Philadelphia, which also supply equipments of a similar kind for lighter work, and for use on ordinary trolley cars, as well as motors for all kinds of pneumatic equipments.

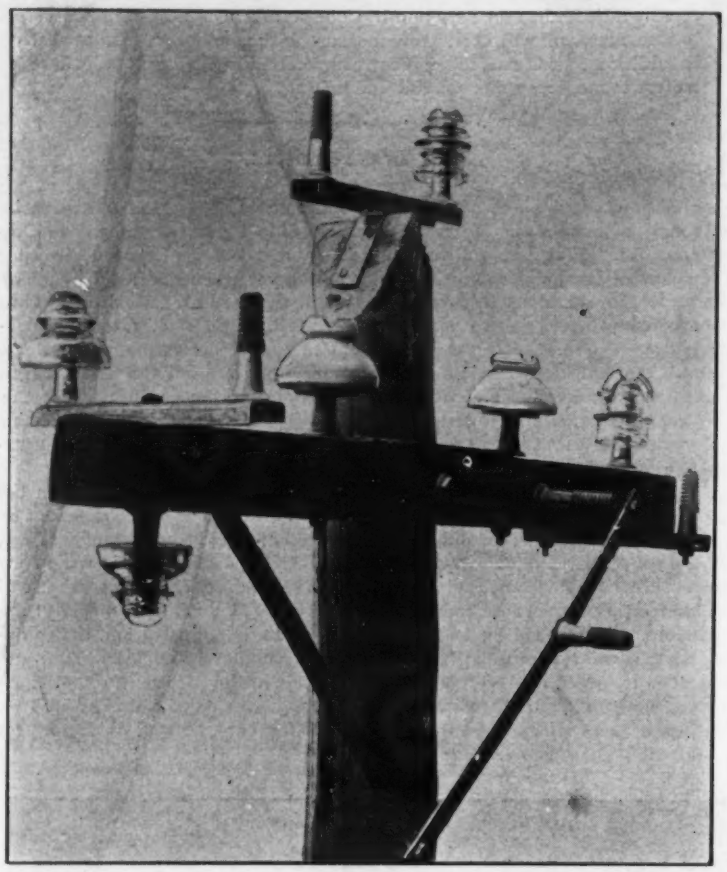


MOTOR FOR AIR-BRAKE SERVICE.

These machines run at a speed of 650 revolutions at 450 volts and develop 3½ horse-power. They are constructed to stand an increase of voltage to 700, and occupy a space over all of 15⅝ by 30½ inches. They weigh 400 pounds, and there are at present 61 of them in operation.

Indestructible Insulating Pin.

The storms during holiday week played havoc with pole lines in many localities, and again directed attention to the desirability of a more secure construction for this vital part of telegraph, telephone and electrical supply systems. Among the devices that have been offered for this purpose



Methods of Applying Insulating Pin.

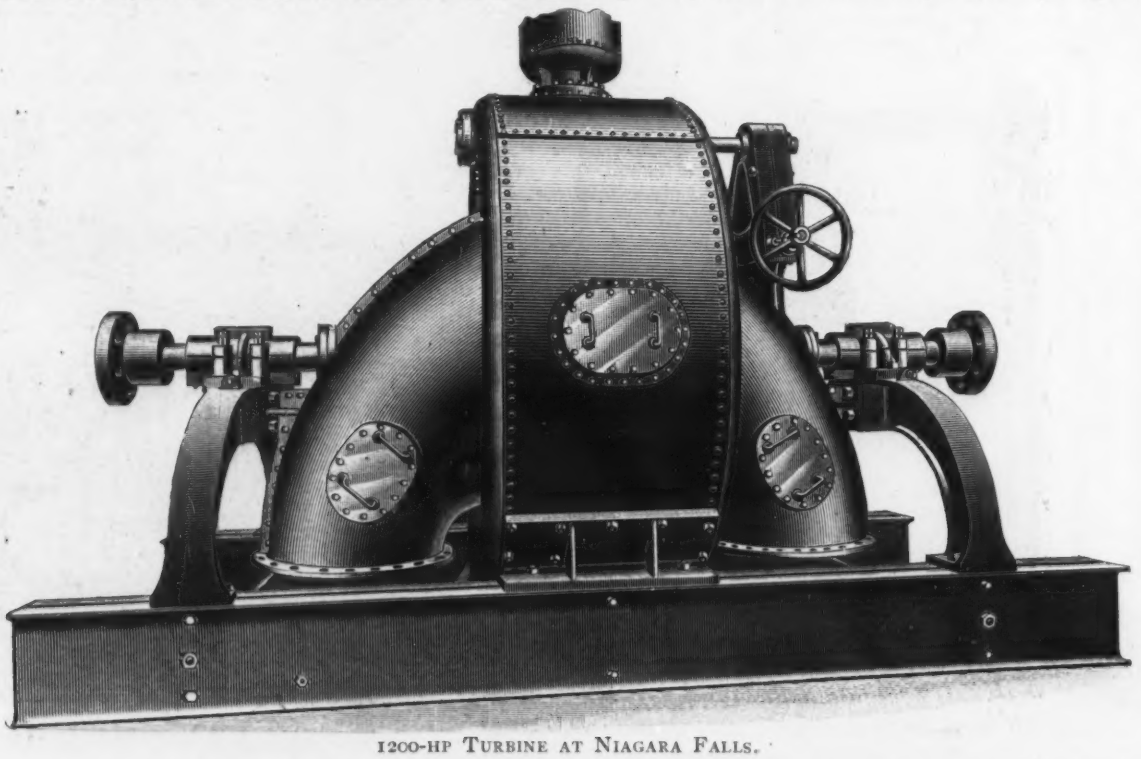
none are better known than those made by Fred M. Locke, of Victor, N Y., and we illustrate herewith his indestructible steel insulating pin, the cut also showing several of the modes in which it is applied to a cross-bar or pole. Among the advantages of this pin are the evident ones that it is unbreakable and does not rot, and that it does not weaken a cross-arm as much as the wooden-driven pin; the securing bolt is less in diameter, and brings no lateral strains on the cross-arm, while the tendency of the arm to split horizontally is resisted by the pressure of the nut. This pin is constructed with a steel bolt passing from the top of the pin through a half-inch hole in the cross-arm, and is securely fastened on the under side by a nut and washer. The iron cap between the top of the insulator pin and the cross-arm serves as a brace to resist the strain of the pull on the pin, and at the same time covers the pin hole in the cross-arm, thereby keeping out water and moisture and preserving the arm. The pins have been extensively used as corner pins and on long-distance transmission lines, where very high potentials are used. They are convenient to replace broken wooden pins, or when extra pins are needed between wooden pins already in use. They can be used bottom side up on the underside of a cross-arm when it is desired to add wires to a line without increasing the number of cross-arms. For iron pole fittings a ⅜ inch by 5 inch pin is made, which can readily be attached, and when in place is neither cumbersome, expensive nor inconvenient, as is the case when ordinary blacksmith fixtures are used. The pins can be attached to the top, bottom and sides of the cross-arm, or to pole-tops, break-arms, or to cross-arm braces. Wherever placed, they present a neat appearance, and may be depended upon to resist all reasonable strains of line construction. The illustration also shows the Locke patent break-arm in position under and on top of the cross-arm, also the Locke large triple petticoat porcelain insulator, triple petticoat glass insulator, transposition insulator and cable insulator.

Niagara Falls Turbines.

We illustrate herewith one of the 1200-hp turbines installed by James Leffel & Co., Springfield, O., in the Cliff Paper Company's mill at Niagara Falls, which is of the same type that will be used in connection with the new electric power plant of the Niagara Falls Hydraulic Power & Manufacturing Company, but is of smaller capacity.

The present plans for the latter plant provide for turbine wheels of the horizontal double-discharge type, furnishing in all about 8000 horse-power. The wheels will be placed on the ground floor of the power house, and will work under a head of 210 feet, which is the highest head under which water has ever been used for power in the quantity which it is proposed to use it in this plant. The pressure exerted is something enormous, and as a consequence the utmost care has been taken in every detail of the penstocks and water wheels, so that they will hold it. Three of these turbines are specified to generate 1700 horse-power each under a head of 205 feet, at a speed of 250 revolutions per minute. The fourth turbine, it is calculated, will develop 1900 horse-power with the same head, at 300 revolutions per minute. As the ordinary head will be from 210 to 215 feet, the power of these wheels will be from 1800 to 2000 horse-power each.

The new turbines will be fitted with runners 74 inches in diameter, made of bronze metal, and fitted with balanced gates; the turbines are so designed that the wheel-runners are absolutely balanced, due to the equal discharge of water on each side, thus doing away with all end-thrust on the shafts. The wheels are fitted in cases 11 feet in diameter, made of heavy plate steel, double riveted. The feeder connection to these large wheel-cases is on the bottom of same, being riveted directly to



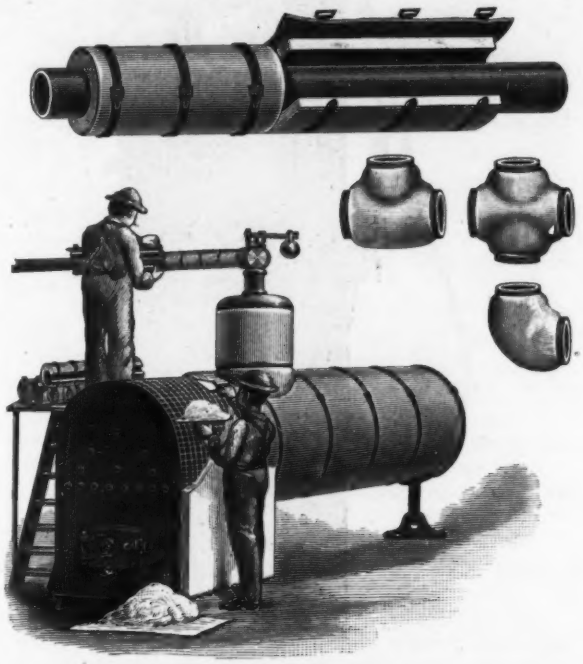
1200-HP Turbine at Niagara Falls.

the five-foot hydraulic cylinder valves. The draft-tubes from the turbines pass down each side of the main feeder pipe, connecting with the tail water. The shafts are carried in adjustable ring oil-bearings,

mounted on heavy iron bridge trees. On each side of each wheel will be placed an electric generator, which will be coupled direct to the shaft of the turbine. Either one of the wheels can be uncoupled at pleasure, and only one run at a time if so wished.

Steam Pipe and Boiler Covering.

It has been said on reliable authority that under ordinary conditions of temperature and exposure of uncovered pipe, the cost of coal at an average price amounts to nearly one dollar a year for each foot of two-inch exposed pipe, containing steam at 60 pounds pressure. The necessity of a proper covering that will prevent the escape of heat from steam-heated surfaces is therefore evident, and the New York Fire-Proof Covering Company, of 21 Liberty Street, New York, offers a material for this purpose, which it claims will meet the desired end in an efficient manner.



PIPE AND BOILER COVERING.

The material used as a non-conductor is rock wool, which is composed of feldspar and limestone, and is somewhat similar to mineral wool. The makers state it is much superior to the latter, however, as it contains no sulphur or anything that will injure iron, and presents minutely divided air spaces, whereby the covering is made very light, containing about 96 per cent. of dead air. Owing to this lightness and the manner in which it is connected it is not affected by vibrations in the pipes, and will not sag or powder in the wrapper. The pipe covering is made in sections to fit any sized pipe, and has heavy canvas casing, with laps and metal bands and fittings to match.

For boilers, domes, heaters, tanks, etc., the coverings are made in blocks from one to two inches thick, these to be covered with wire netting and a coating of rock wool cement, making a smooth, hard finish. A rock wool fire-proof cement which can be mixed with a trowel and applied like mortar is provided for covering irregular-shaped surfaces. The covering is in each case very simple of application, requiring no skilled labor.

The Telephone Applied to Electric Roads.

An interesting application of the telephone to electric railway work has recently been made by the National Telephone Company, of Boston. The conditions of the work were of such a nature that the ordinary instruments would not be at all satisfactory, as the wires were required to be strung on the same poles with electric railway feeders, and leakage and induction would have rendered an instrument of the usual type so noisy that nothing intelligible could be transmitted.

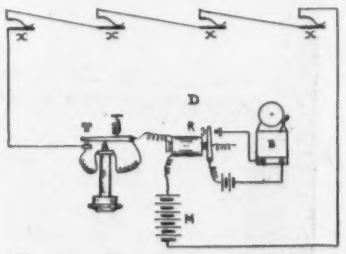


FIG. 1.—DIAGRAM OF CIRCUIT.

A diagram of the wiring is shown in Fig. 1. The circuit, as will be seen, is a series-loop with a closed system in which current normally always flows. Several cells of gravity battery, *M*, constitute the main battery, *XX* represent pole stations and are spring-clips between which a jack-plug may be thrust to insert an instrument in circuit. *D* is the recording station, the apparatus of which is shown in Fig. 3; one of these is located at the power-house and the various company offices, and each has a definite tap signal.

The instruments used are very simple, consisting of a double-pole magnetic receiver, and a granular carbon transmitter, adapted to pass a very heavy current. Both of the instruments are very small, and are mounted on a handle conveniently arranged to hold the receiver at the ear and the transmitter in front of the mouth at the same time; no induction coil is used. The hand instruments are shown in Figs. 2 and 3 and are used at all the stations.

On the handle of each telephonic set is a little push-button which opens the relay circuit at *D*, and gives the tap signal by means of the local bell at *C*. The operator at the station signaled takes down his telephone and thereby cuts it into the circuit. The signaling party at the distant pole can now communicate with the station whose signal he has sent. In jacking in he listens for a moment to see if the line is in use, and then signals.

FIG. 2.—A STATION.

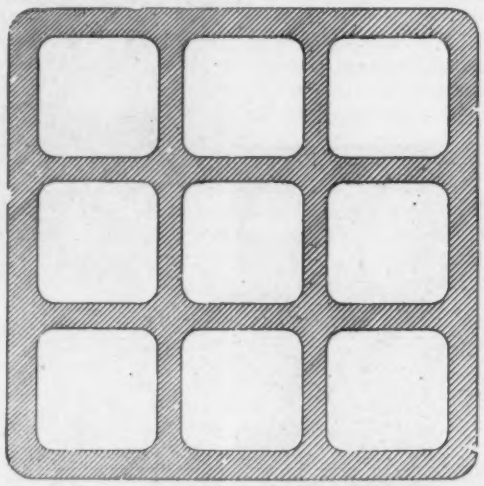
FIG. 3.—INTERIOR OF RELAY BOX.

Every conductor is supposed to carry a telephone, such as is shown hanging to a relay-box of Fig. 3, which is so small and compact that it can readily be carried in an overcoat pocket. The pole stations are merely little cast-iron boxes, such as are shown in Fig. 2, and have an opening in the bottom into which the jack-plug may be thrust. By means of this telephone system much time may be saved in an infinite number of cases. It is stated that these instruments are proving eminently successful on a line built after the above description, and in spite of the heavy battery current, and the induction and leakage of the power wires, speech is transmitted with ease.

FIG. 4.—REPORTING TO HEADQUARTERS.

Vitrified Terra-Cotta Conduit.

There has recently been placed on the market a vitrified terra-cotta conduit, developed by Mr. J. F. McRoy, of 36 South Clark Street, Chicago, Ill., for underground electric line purposes, and which we illustrate herewith. The conduit is composed of shale, which is first thoroughly triturated and then densely compressed by special and very powerful machinery designed for the purpose, into a multiple-duct conduit of any desired number of compartments and cable capacity. The illustration shows in cross-section a new multiple-duct conduit, having ducts of 3¼ inches area each. A number of points of advantage over other conduit constructions



Conduit for Underground Wires.

for underground purposes are claimed for this conduit, the main features being the character of material used in its construction; the manner in which the material is prepared for use; the thoroughness of the compression into form; the length of conduit sections (averaging about 2½ feet each); the complete vitrification of the material and glazing of surfaces, and the absence of all projections in any manner likely to jeopardize the outer covering of cables in "drawing in." A still more important claim is the protection which the conduit affords to the cables which it carries against electrolytic corrosion due to the return currents of electric railways.

Small Exchange and Interior Service Telephones.

Among the telephone manufacturers early in the field to take advantage of the expiration of the Bell patents was the Missouri Telephone Company, of St. Louis, which, during the last two years, has perfected a number of types of transmitters and receivers. In Fig. 1 we illustrate an instrument designed for use in small towns that cannot afford the expense of keeping a night and Sunday operator, and for other small exchange work. It is built for any number of stations up to twenty, each telephone with its own switchboard by means of which connection can be made with any other instrument on circuit. A special feature of this and the other instrument here described is what is termed the "Parker-Kusel Guard," which is a device to guard against connection being kept with another instrument after a conversation; it consists of an automatic arrangement connected with the receiver hook in such a manner that when the receiver is hung up a guard bell will ring until the switch plug is removed.

Fig. 1.—Instrument for Small Exchanges.

Fig. 2.—Interior Service Instrument.

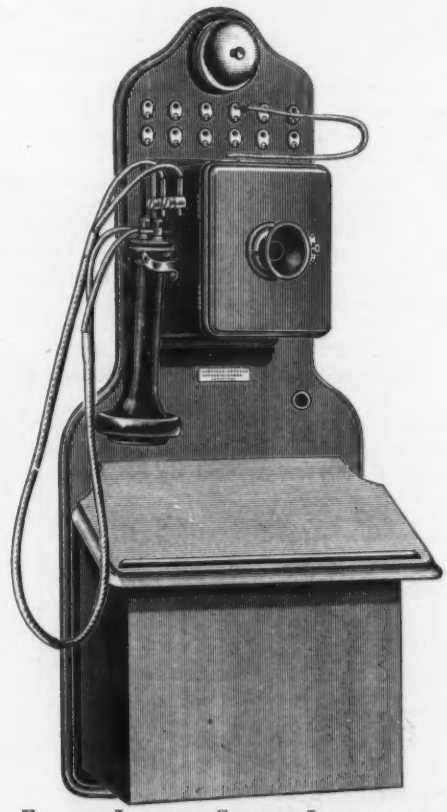


Fig. 3.—Interior Service Instrument.

Fig. 2 illustrates an interior service plug telephone. Fig. 3 represents an instrument of the same type as Fig. 2, but with a double battery box and back board attached, as well as a writing desk.

1895 THE BUSINESS WORLD 1896

As a medium to offer a New Year's greeting to our readers, and in order to present to them a review of the electrical industry, the firms having connection with that industry, whether directly or indirectly, were invited to make through these columns such statements concerning themselves and their business as they thought might be of interest. While the space occupied has exceeded the limits originally intended, yet it is with pleasure that we print the following responses to our offer, and present to the gentlemen represented our most hearty wishes for a successful and Happy New Year.

SEELYE & BURNHAM, Luzerne, N. Y., will early in the year place on the market a trolley pole possessing a number of valuable features, among which is one preventing the wheel from leaving the trolley wire. Patents have been secured for the invention in the United States, Canada, Germany, England and France.

THE ENTREKIN-ELDER ELECTRIC COMPANY, Harrisburg, Pa., makes a specialty of electric light wiring, telephone and bell work, and is the agent for the Tucker Construction Company's "Auto-Telephone" system for Central Pennsylvania. It carries a full line of supplies for all lines of electric work, and is always up to date in everything electrical.

THE QUAST GAS ENGINE COMPANY, of Strasburg, Ill., is running day and night to supply orders. It is making a special gas or gasoline engine, for electric light purposes, which runs at a very high speed, and can be connected directly to the dynamo. The Quast engine is extremely simple in construction and runs as quietly as a good running steam engine.

THE WHEELER REFLECTOR COMPANY, 18 Washington Street, Boston, reports an unusually good year in goods of its manufacture, especially in reflectors for electric lights and in electric and oil headlights for street railways; also in the specialty of goods particularly adapted for show-window lighting. Its several catalogues on these lines are instructive and valuable.

THE ROYAL ELECTRIC COMPANY, of Peoria, Ill., although manufacturers of both direct and alternating-current apparatus, makes a specialty of alternating-current dynamos. There are very few people who have not heard of the "Royal" alternator. This alternator is of the induction type and possesses many admirable features, such as no moving wire, no commutator or collecting rings, and no brushes.

THE W. C. VOSBURGH MANUFACTURING COMPANY, LIMITED, of Brooklyn, makers of electric, gas, and combination fixtures for lighting purposes, has been especially successful of late in securing many large contracts throughout the States and Canada, among which has been the supplying of fixtures for 28 churches, a number of court houses and several theatres, the new Montauk Theatre, of Brooklyn, being one of them.

THE TUERK WATER MOTOR COMPANY, of Fulton, N. Y., which has manufactured water motors and belt ventilating fans of all kinds for several years, put on the market last year an electric ceiling fan for direct currents, which gave good satisfaction; it is now ready to supply the trade with an alternating ceiling fan, operated by a motor which has no commutator or brushes to look after, with all bearings running in oil.

THE INDEPENDENT ELECTRIC COMPANY, of Chicago, reports a very satisfactory business during 1895, particularly in its fuse wire department of which Mr. W. R. Goodman is manager. This company is a pioneer in the manufacture of fuse wire, and its products can be found in all quarters of the electrical field. It is at present making a specialty of a very fine and accurately rated fuse wire for telephone and telegraph work.

SMETHURST & ALLEN, electrical engineers and contractors, Betz Building, Philadelphia, have had a highly successful and encouraging business year, and judging from the present outlook, next year bids fair to be one of the most prosperous in the history of electric street railway work. While electric railway work is a specialty of this firm, its business also includes the installation of complete electric light and power installations.

BIDSTRUP & GRAHAM, 35 Frankfort Street, New York, have met with gratifying success in the sale of their "Economic" dynamos and motors. These machines are for 110, 220 and 500 volt circuits, and among the features claimed are a design which does not conflict with stability of construction, insulation of the best quality and carefully applied, a ventilated armature, self-adjusting brushes and material of the best quality in all parts.

THE MAIN BELTING COMPANY, of 1235 Carpenter Street, Philadelphia, manufacturers of the well-known "Leviathan" belting for electric lighting and all other purposes, is a member of the Philadelphia Bourse, and occupies a space of 60 square feet in one of the most prominent parts of the floor, it being in the exact centre. There it has placed on exhibition a complete line of its various forms of belting, including its endless dynamo belt, which is a leading specialty with the company.

THE PROCTOR-RAYMOND COMPANY, of 444 Niagara Street, Buffalo, N. Y., which recently purchased the business of the Proctor-Raymond Electric Company, of Rochester, reports large sales for its goods, and especially for the "Improved Eclipse" iron-box and "Rex" wood-box bells. It is now busy completing its line of electrical house and hotel furnishings, and claims to have some big surprises in store for the trade in the way of improvements.

THE ELECTRIC HEAT-ALARM COMPANY, 145 High Street, Boston, found the year 1895 a very good one from a business standpoint. In it some very good contracts were closed, among others the equipment of United States men-of-war *Marblehead*, *Massachusetts* and *Indiana*, and at present the *Oregon* and *Maine* are being equipped with its thermostats, most of this work being done through its New York agents, Charles Corey & Son, 278 Division Street.

HUEBEL & MANGER, Brooklyn, N. Y., say that the usual lull at the closing up of the year's business has not been perceptible to them this year; this month has been better than last and last was better than the preceding one, and now their aim is to make next month better than this has been. With business on the advance and their goods continually becoming more and more in demand, and with their usual amount of energy they will undoubtedly do this.

THE LAW BATTERY COMPANY, 39 Cortlandt Street, New York, whose lines of law cells and electro-therapeutical apparatus are so well known, continues to base its policy on the fact that only goods embodying the very best materials in their construction are capable of giving uniform and lasting satisfaction, and therefore turns out none other. Being manufacturers in the fullest sense of the word, it is in a position to meet the requirements of the trade at every point.

THE AMERICAN CARBON COMPANY, Noblesville, Ind., has been experimenting the past year to improve the quality of its carbons, and has succeeded in producing a carbon which it believes has no superior in point of workmanship and excellent burning qualities. It is now pushing work on its factory, and has recently closed a number of large contracts with some of the largest consumers in the country. It has also increased its capacity, and can now handle large business promptly.

THE E. P. BARRETT MANUFACTURING COMPANY, 81 Sudbury Street, Boston, Mass., has become well known in the electrical field through its high grade of plumbers' specialties, among which are the Zane self-closing ball-cocks and faucets, anti-friction metals, aluminum and brass castings, solder, etc. It has introduced in many central stations, power houses and electrical factories the Barrett low-tank, compact and sanitary water closet, which is claimed to be the best in the market.

MARIS BROTHERS, 2343 Callowhill Street, Philadelphia, report business good in their line, and the outlook for next year very encouraging. They have improved their crane hoists as well as cranes and now have the best machines in this line built. The two-speed hoist is an especially valuable improvement, as it renders the handling of light loads much quicker and more economical than using the slow speeds necessary for hand machines for heavy loads, and where but one speed is provided.

F. E. BAILEY & CO., Betz Building, Philadelphia, have recently placed on the market their new rival oil purifier, which is an evolution in its line, profiting alike by the successes and failures of others, as well as by their own experience as builders of oil purifiers. This type of filter does not contain any filtering compound or material, such as felt, charcoal, ground cork, mineral wool, cloth, sponge, etc., any of which soon become clogged and foul, and in a short time worse than useless.

THE AMERICAN ELECTRIC FUSE COMPANY, 87 Washington Street, Chicago, has perfected its improved "American Solid Joint," which it claims to be far superior to any joint on the market to-day for joining telegraph, telephone and electric light wires, forming as it does one solid mass without heat or solder, and, besides, costing less than any other joint made. It is also having a big demand for its improved telephone and telegraph porcelain cut-out and mica fuse.

THE ONONDAGA DYNAMO COMPANY, of Syracuse, N. Y., is making a special run on its instruments, both volt and ampere meters, having had a wonderful success thus far in the sale of them. They are electrically and mechanically perfect in their construction and are finely finished. These instruments are selling rapidly on account of the extremely low prices at which they are sold. We are advised that they are looking for reliable agents to represent them in localities which are not already covered.

THE AUSTIN SEPARATOR COMPANY, Detroit, Mich., reports business as being exceptionally favorable. During the last few months it has, in

addition to its regular horizontal and vertical machines, placed on the market a horizontal type suitable for steam connection from 12 inches upwards. The shells are of the best boiler plate steel, and they are substantially constructed and braced to stand the highest pressure that may be required. The Austin Company does not hesitate to send its machines out on trial.

The Foster Engineering Company, of Newark, N. J., reports a satisfactory demand for its pressure regulators and reducing valves, not only in railway and shipbuilding lines, but in general manufacturing industries. It points out that the recent fearful fatalities on the steamship *St. Paul*, and in the engine room of the new Olympia Theatre, New York, would have been averted by the application of its automatic safety stop-valve. In the electric field the Foster regulator is in growing demand for light, power and traction plants.

The J. M. Carpenter Tap & Die Company, of Pawtucket, R. I., one of the oldest manufacturers of screw-cutting tools in the United States, has a factory equipped with special machinery, mostly of its own design, for the rapid and accurate manufacture of all descriptions of taps, dies, screw-plates, etc., and make a specialty of first-class screw-cutting tools especially adapted to the wants of manufacturers of electrical apparatus. With its 25 years' experience in this line this firm has attained an enviable reputation.

The Sunbeam Incandescent Lamp Company, Chicago, has recently commenced the manufacture of 2 cp, 10-watt, and 4 cp, 20-watt, incandescent lamps. These lamps have a small round bulb, and are fitted with regular standard sockets. The principal use for these lamps will be in sign and decorative work. In sign work especially a lamp of low candle-power is preferable, even without considering the saving in energy, as with the glow of the small incandescent lamp the sign is clearer than with the glare of the larger lamp.

The International Electric Company, 76 Beekman Street, New York, is building up a large trade in Ruhmkorff induction coils, in the manufacture of which the utmost care is employed to ensure reliability. They are supplied with an automatic break, the spools are mounted on highly polished mahogany bases, and an unusual length of spark for each size is guaranteed. In addition the company manufactures binding posts, cord tips and other brass machine work, does experimental model work and perfects inventions.

George Cutter, 851 The Rookery, Chicago, otherwise known as "The Electric Specialist of the West," has done his share during 1895 toward stamping Chicago as headquarters for modern and practical devices. The last year brought to light the running form of his lamp-supporting pulley, also a combined geared and gearless windlass, a waterproof pole-lock for hoisting ropes and the new "always level" suspension street-hood. The latter seems to have solved the problem of suspending street-hoods properly in spite of wind and weather.

The "I X L" Tempered Copper Company, 66 Elk Street, Buffalo, N. Y., has been in operation about two years, and is having a steady increase of business. It makes a specialty of commutator copper, and offers to make a sample order for any reliable firm, which, if it does not prove to be as represented, will be presented free of charge. By the good inducements offered to its customers and by good management in its works, the company is rapidly forging to the front, having already become very generally known throughout the country.

The Phœnix Interior Telephone Company, of 131 Liberty Street, New York, is kept busy supplying the demand for its long-distance telephones, Nos. 9 and 10, which are strictly up to date, and meet the requirements of progressive independent exchanges all over the country. Its factory has been working overtime for the last month to keep up with orders. The superior quality of its goods and its business methods have made many friends in the trade, so much so that the first order is invariably followed by other and larger ones.

Robert Anderson, of Ottawa, Canada, cannot complain of lack of business encouragement, as the following recent contracts for plants testify: 750 lights at Pakenham, Ont., for J. H. Francis, including street lights; 600-light plant at Eganville, Ont., for J. D. McRae and 150 horse-power in electric motors; 150-light plant at North American Graphite Works, Buckingham, Ont.; 150 lights at C. P. R. Union Depot, Ottawa, Ont.; 200 extra lights, W. C. Edwards & Co., Ottawa, Ont., in their sash and door factory; also 500 in their saw-mill.

The Electrose Manufacturing Company, situated at 216 and 218 William Street, New York City, where they occupy over 12,000 feet of floor space, reports business in a flourishing condition and is now booked several weeks ahead of its output. The superior finish and quality of "Electrose" and the careful attention given to details by this company are meeting with the proper appreciation, and the "Electrose" people now number among their customers nearly all the large telephone manufacturers and electrical supply houses in the country.

The Elevator Supply & Repair Company, 36 West Monroe Street, Chicago, is utilizing phosphor-bronze with much success in the manufacture of dynamo and motor brushes, which has placed a new brush called the "Best" on the market. This brush is meeting the demands where other wire-gauze brushes fail with dynamos, giving the electrician annoyance by sparking. Working against a metal of different properties, this brush is a good conductor, noiseless, flexible, and commends itself to all electricians by its economical and labor-saving service.

Gill & Co., electrical engineers and contractors, 603 Penn Mutual Building, Philadelphia, report a success that thus far has been remarkable. Their chief line of work is the construction of electric railways. A monument to their skill in this line is the Electric Traction system of Philadelphia, embracing about 125 miles of track, and considered the finest electric railway system in the country. They are also thoroughly equipped in all other lines of electrical work, and during the coming year expect to even exceed their great success of the past year.

The Mountain Electric Company, 532-536 Seventeenth Street, Denver, Col., has been in business now about five years, and handles general electric supplies and appliances. It also installs electric light plants complete and has built and equipped some of the largest isolated and central station plants in Colorado. With its experience and as agents for the Westinghouse Electric & Manufacturing Company, of Pittsburg, and the Western Electric Company, of Chicago, it is enabled to offer to their customers the utmost facilities for obtaining perfect work.

A. O. Schoonmaker, 158 William Street, New York, makes a specialty of Solid Sheet Mica for all electrical work. This term originated with Mr. Schoonmaker about two years ago, to distinguish mica in its native condition, as it is mined, from substitutes that are being put on the market under various names. He claims that to have the most perfect insulation mica should be used in *solid sheets*, just as it comes from the mine, and it is only in this form he offers it to the trade. His large stock of both India and Amber mica comes direct from the original source.

Hanne Brothers, of Jacksonville, Fla., have recently produced wire reels differing in construction from the old-time horizontal revolving reel. It is a reel for which the merit is claimed that it is quick working, involving no kinks, no spirals, no twisting of wire by stretching, and is, last and not least, a perfect combination reel sold about as cheap as the unsightly old-time reels. It is now in use by many of the shrewdest buyers, who want the best and are willing to pay for it. The manufacturers state they will ship them on trial to any responsible buyers.

The C. & C. Electric Company, 143 Liberty Street, New York, has completed during the past year its line of multipolar dynamos for direct connection to engines in sizes from 25 to 200 kw, and is now busily engaged in completing a line of small multipolar motors and dynamos in sizes from 3 to 25 horse-power. These latter machines will be wound for two speeds, low and medium. The manufacture of the well-known circular-field bipolar type of motors and dynamos will be continued, and, with the new ones first mentioned, affords a line of machines to fill any requirement.

The Berliner Telephone Company, Lincoln, Ill., is manufacturing a special instrument for long-distance service, on which no expense has been spared to make it what the best service requires. Among recent contracts completed is one for 180 miles of toll lines, metallic circuits on cross-arms, for the Logan County Telephone Company, of Lincoln, Ill. Recent shipments of exchange apparatus go to Illinois, Tennessee, Mississippi, New Hampshire and Texas. The Berliner Company bases its success on the quality of its apparatus and the fair dealing of its officers.

The Rockwood Manufacturing Company, Indianapolis, Ind., recognizing the fact that the effectiveness of most belted machinery is dependent on a uniform speed, and understanding the unreliability of iron, wooden, and covered iron pulleys, determined to make pulleys of paper, believing they would overcome the annoyance and loss occasioned by slipping belts. That it was not mistaken is evidenced by the steady and increasing demand, especially by the electrical trades, and others where the highest belt efficiency is necessary to the successful operation of their plants.

W. D. Hoffman & Co., of 620 Atlantic Avenue, Boston, are preparing some special designs for both electric railway and lighting services, in which the Slater engines are introduced in horizontal and vertical forms for moderate speeds from 90 up to 135 revolutions per minute, direct-coupled, and Dick & Church high-speed engines in all its types in speed from 180 to 350 revolutions per minute, also direct-coupled. The matters of alignment and adjustment are particularly cared for, and the weight of base pieces, etc., are suited to the heaviest loads and most trying conditions.

The Electric Appliance Company, of Chicago, reports that its sales of the Packard transformers exceed even its greatest expectations, and claims that after handling the same for three years, it has yet to receive the first one to be returned, burned out by lightning. It also claims that it carries a complete line at Chicago, and can ship any orders promptly from stock. It is generally supposed that the demand for weather-proof wire is limited after Dec. 1, but the Electric Appliance Company reports that their sales are increasing, and, if anything, are larger than during the Fall months.

The Crown Woven Wire Brush Company, of Salem, Mass., has recently put on the market a new brush, which is meeting with a large sale. It is called the "Crown K," and is the only brush of its kind made in this country, being very similar to the German brush. It is made with a finely braided core, covered with very fine cloth, woven after the manner of lace; the brush is sewed firmly together, which prevents it spreading at the ends—a fault very common in most brushes. The firm repors

large sales recently made, and that their goods are being sent to many foreign countries.

THE GARLOCK PACKING COMPANY, of Palmyra, N. Y., and Rome, Ga., manufacturers of the well-known "Garlock" packings of every description, is the owner of numerous patents and secret processes, which, together with the superior quality of material used, enables it to sustain the high reputation its goods possess among engineers, consumers and dealers. The packings manufactured by the firm embrace a long line for steam, gas, water and ammonia, and the former have entered largely into use in central and power stations, for which a special brand of high-pressure packing is made.

H. B. COHO & Co., 203 Broadway, New York, are a comparatively young firm, Mr. Coho starting for himself after the failure of the Waddell-Entz Company. Though in existence less than two years, they have installed plants in twenty large buildings and factories, their largest plants being in Hammerstein's Olympia Theatre, where they installed four 100-kw Eddy generators, and in the New York *Herald* Building, where they installed four 60-kw Eddy generators. Messrs. Coho & Co. are agents for a number of good concerns, and handle alternating and direct-current machinery.

THE J. H. MCEWEN MANUFACTURING COMPANY, 26 Cortlandt Street, New York, the well-known manufacturers of steam engines, has entered the electrical field with the Thompson-Ryan dynamo, which, since the underlying principles were first presented to the public by Prof. Ryan, of Cornell University, has attracted so much attention from electrical engineers in both the United States and Europe. This dynamo is a radical departure from the well-beaten path followed by other manufacturers, but that such a departure is justified the connection of Prof. Ryan's name with it furnishes ample evidence.

THE WEBSTER CHEMICAL COMPANY, of St. Paul, Minn., recognizing the part which electricity has come to play in decorative illuminations, and the important factor of colored incandescent lamps in this branch, has invented a process whereby lamps may be successfully colored, producing any desired effect. The process is very simple, merely dipping the lamp into "Crystal Chemical Coloring," a liquid made by it, the lamps drying instantly and thus are ready for use at once. This application lasts the full life of the lamp, or it can be removed by hot water, leaving the lamp in its original condition.

THE CARDARELLI MANUFACTURING COMPANY, 77 North Street, Boston, calls attention to the "Victor" mast-arm now being made by it. Among the advantages claimed are that it is the only mast-arm that will lower the lamp to the base of a pole of any height, and replace the same without the trimmers moving away from the base of the pole, thus saving at least 50 per cent. of trimmer's time. In cheapness and strength the manufacturers claim it to be the most desirable mast-arm on the market. Electric light companies and other concerns having use for such an article speak of it in high terms.

THE PHILADELPHIA ELECTRICAL & MANUFACTURING COMPANY, Philadelphia, has been fortunate in securing the Metropolitan Electric Company, of Chicago, as its Western sales agents, which is evidence that their interests will be well looked after in that section. The Philadelphia Electrical & Manufacturing Company's goods have established for themselves an enviable reputation, and the station superintendent who has never used any of its arc cut-outs, carbon holders, etc., has missed some of the best goods to be had in this line. The company reports that it is doing about three times the business it did at this time one year ago.

THE OHIO ELECTRICAL WORKS, Cleveland, O., has succeeded in solving a problem of considerable difficulty, and one on which much effort and money has been expended—the production of an efficient electric light for the necktie. Though but recently placed on the market, the sales have been so large as to necessitate doubling the capacity of its plant. The sales in this country, Canada and Mexico exceed 15,000 a month, and one export house in New York will require the same number for all foreign countries, for which a contract has just been closed.

THE CHAPIN-DOUGLAS ELECTRIC COMPANY has been recently organized for the purpose of doing a general supply and specialty business with offices at 136 Liberty Street, New York City. The president, Mr. Charles E. Chapin, is well and favorably known to the supply trade, and Mr. J. S. Douglas, the treasurer of the company, is an electrician of experience. The new firm in addition to the supply business is manufacturing specialties, including the "Perfection" woven wire brushes, C.-D. rosettes, etc. The company is also agent for the Burnley soldering paste and the J. Grant High switchboards and switches.

FRANK H. STEWART & Co., of Philadelphia, handle everything from a push-button to a dynamo, and report a rapidly increasing business, notwithstanding the dull times. The "Stewart" incandescent lamp, manufactured by them, is surpassing their expectations, and duplicate orders are constantly being filled. In order to meet the demand for a cheap and serviceable knife switch, they are making one that sells itself. It is mounted on polished slate base, and presents a very attractive appearance. They make these switches by the thousands, and until recently were six weeks behind with their orders, but are now ready to ship from stock.

THE GOULDS MANUFACTURING COMPANY, Seneca Falls, N. Y., considers that while the year 1895 deserves to be classed as phenomenal on many scores, from the Chief Executive's "Jingo" message down to itself, it has been almost more than this. The business of the company, both foreign and domestic, has been most flattering, and has kept up in volume unusually late in the season. In addition to this, the company have brought out a large line of new goods, from small bicycle pumps to large triplex power pumps, and can point with pride to several electrically operated water-works plants installed in different sections of the country.

THE STOREY MOTOR & TOOL COMPANY, of Philadelphia, is preparing a new catalogue, to be issued shortly, a copy of which it desires to furnish to every one interested in direct-connected and special applications as well as standard motor work. During the past year it has covered a large field in special work of all kinds, having designed and furnished motors varying in speeds from 175 to 3500 revolutions and in voltages from 25 to 700. While it manufactures motors for standard work of every description, yet its principal business is in the line of special combinations, a number of which will be illustrated in the new catalogue.

THE LOUISVILLE ELECTRICAL WORKS, located at 1307 to 1315 West Main Street, Louisville, Ky., of which Campbell Scott is the general manager, although having been in business but little over a year, have recently found it necessary to lease a much larger factory in order to properly and promptly meet the demand, which is daily increasing, for their well-known line of "Phœnix" transformers. This concern is devoted wholly to transformer manufacture, and now have one of the largest, most complete and most excellently equipped factories in this country devoted to the manufacture of this class of apparatus.

THE SHULTZ BELTING COMPANY, St. Louis, Mo., through its president, Mr. J. A. J. Shultz, states that while the year just closing has not been all that business men hoped it would be, still it was found better than the previous year, and the trade of the company increased considerably over the previous year, both in this country and in Europe. Mr. Shultz is of the opinion that we are gradually approaching better times, yet he cannot see how we can have permanent prosperity until the agricultural classes receive better prices for their products and the idle laborer is employed, as from these two sources come the circulation of money and prosperity.

THE CHLORIDE OF SILVER DRY CELL BATTERY COMPANY, of Baltimore, Md., is now using the "Willms" interchangeable form of cell in all its test batteries, which is a great convenience to the electrical profession and electrical supply houses as well, for any one cell can be removed, should it become exhausted, without disturbing the others. The improved cells also avoid all danger of broken connections, and no metal is employed which will in any way affect the magnets of measuring instruments while making tests. Each part of its new-style battery is interchangeable, and all necessary tools for making repairs accompany each instrument.

THE PAIRPOINT MANUFACTURING COMPANY, New Bedford, Mass., owning and operating the celebrated Mt. Washington Glass Company, has been running to fullest capacity during 1895, on incandescent lamp bulbs and glass tubing used in connection therewith. It has also done an extensive business in the McCreary silvered reflector shades and a general line of incandescent and arc shades and globes in clear and opal glass, for which this factory has a national reputation. The works have superior facilities for making all kinds of glass tubing for electrical, chemical or medicinal purposes, having, during the year, erected special buildings for this branch.

FRED. W. RICHART, of Carbondale, Ill., does exclusively an engineering business. His specialties are in the design and construction of electric light and steam plants, and the testing and improvement of existing plants. Attention will also be given to the design of hoisting and screening plants for bituminous coal mines. The advantages he offers are not only an engineering education, but the practical experience of erecting, operating, repairing, testing and managing of these classes of machinery. Particular attention in designing is given to the points of convenience, safety and economy in operation, and stability in the installation.

THE ROE STEPHENS MANUFACTURING COMPANY, Detroit, Mich., early recognized that with the establishment of high-pressure steam plants for electric lighting, etc., valve makers would be obliged to meet the conditions involved by designing extra heavy gate valves, and therefore early entered the new field with valves adapted to the service required. Aside from the Scott gate valves, so well known among engineers, the company manufactures the Goldsmith throttle valve, the Scott pop safety valve, the Rouse check valves and Orme safety and relief valves as specialties. Electric light men will find the catalogue of this company of much interest.

ED. WERTHEIM, 55 Canal Street, Chicago, represents the Union Carbon Works, of Kronach, Germany, manufacturers of soft cored and solid carbons for electric lighting, and has among his customers some of the largest electric companies in this country, besides a great number of stores, hotels and other consumers of carbons. These carbons have been tested by a great many experts, and among them by Prof. Stine of the Armour Institute, Chicago, who pronounces them to have the larges

life of any he has tried, giving the steadiest and most brilliant arc. To our readers, samples will be sent free of charge if they will give the size which they can use on their lamps, and furnish such further information as may be required.

The Pittsfield Electrical Supply Company, of Pittsfield, Mass., has just rounded the first milestone and has already gained the confidence of the most exacting users of incandescent lamps. Its trade consists mainly of supply houses, central stations, and isolated plants. It has also built up a fine trade among hotels, theatres, and large stores. Its lamps have given unusual satisfaction, and the firm can truthfully say that it yet remains for a complaint to be made by any purchaser of its high-grade lamps, and particular success has been met with in cases where trouble has been caused, such as varying of candle-power, blackening, short-lived, etc.

The James Smith Woolen Machinery Company, 411 Race Street, Philadelphia, to sustain its claims that power, utility, simplicity, durability and reliability never had more perfect exemplification than in the justly celebrated hub friction clutch which it manufactures, points to the 30,000 now in use as irrefutable witnesses. All parts of the clutch are cheaply and readily duplicated and made of the best materials, a combination of cast iron, spring steel, wrought iron and metaline, with special adaptation for heavy hauling and all electric light and power work. It is applied or disconnected with ease, regardless of speed, and once used have never been rejected or replaced.

The Standard Electric Time Company, of Waterbury, Conn., apply electricity in a most practical way to indicate on many dials the accurate measurements of time by a single accurate time-keeper. For master clocks are used its reliable self-winding regulators, and an automatic programme bell ringing attachment is run on the same accurate time. This may also be said of the electric tower clock, the watchman's clock, and the electric time register made by this widely-known firm, whose battery gauge, by the way, is the only one of its kind. Simplicity, reliability and completeness are the watchwords that have led to the enviable reputation enjoyed by this firm.

S. E. Daniels, Jr., of Provo, Utah, has been a practising electrical engineer since the early part of 1885, during which period he has obtained a number of important patents on dynamo and motor construction. He was constructing engineer of the Provo and Payson central stations, as well as of a number of important isolated plants. In his supply department he keeps on hand a full line of general electrical supplies, and in the repair department rewinds and rebuilds any make or type of dynamos, motors, convertors, recording volt and ampere meters, etc. In 1889, Mr. Daniels constructed the first dynamo ever made in Utah, and which is still doing good work.

The Royal Electric Company, of Montreal, is the oldest electrical manufacturing concern doing business in Canada. Until within the past year it has been manufacturing under Thomson-Houston patents and has installed a large number of central station and isolated plants throughout Canada, both arc and incandescent. It has recently acquired the exclusive right to manufacture in Canada the S. K. C. two-phase alternating-current apparatus as designed by the Stanley Electric Manufacturing Company. It also manufactures a full line of direct-current lighting apparatus, street railway generators, motors and equipments and also does a large supply business.

The Scott Electric Lamp Company, 126 Liberty Street, New York, established in 1889, was the first electric company to bring out an efficient marine search-light at a low price. Its apparatus is known as the "Huntington Search and Position Light," and can either be placed on top of the pilot-house with patented gear to work it from inside, or can be placed forward on deck without controlling attachment. It is made for any candle-power desired, 20 amperes being sufficient to show the course of a schooner a mile distant. The company have also the highest reputation for their automatic focussing lamps for all kinds of photographic work and theatrical scenic effects.

The Ashton Valve Company, 271 Franklin Street, Boston, finds a proof of the proverb "many a mickle makes a muckle," in its experience. In 1871 a small effort was made to bring the attention of steam users to improvements in safety valves, and the Ashton "Pop" valve, from being a puling infant, grew to become a sturdy youth. These efforts were accepted and fully appreciated, and now the Ashton Valve Company in its full growth is equipping some of the largest railways and manufacturing plants in the country with its well-known mufflers, pop-valves and cages. Efficiency and durability becomes the motto—quality is never sacrificed for price—the best is cheapest.

The Sydite Chemical & Manufacturing Company, 822 Broadway, New York, are importers and manufacturers of the highest grades of insulating wares and paint compounds. They are the sole proprietors and manufacturers of the famous "Sydite Wax," which is rapidly taking the place of all other wax compounds. It is perfectly waterproof, gas proof and acid proof, pliant as rubber, of a lustrous black color, and is susceptible of a very high polish. During the past year the demand for it has taxed the capabilities of their factory to its fullest extent, requiring them to run day and night. For this year they have increased their facilities in order to fill orders promptly.

The Dean Brothers Steam Pump Works, Indianapolis, Ind., in addition to steam pumps, manufacture power pumps, electrically driven pumps, and air pumps and condensers for power stations. Both surface and jet condensers are made. The magnificent manufacturing facilities of this company are evident from the statement that the buildings, which are of brick, are 60 feet wide by 1000 feet long, all connected together, and especially designed for manufacturing pumping machinery. The foundry and shops are fitted with improved power traveling cranes, and all departments are lighted by electricity. At present their works are employed to their full capacity.

The Automatic Long-Distance Telephone Company, of Chicago, is meeting with a good demand for its new rotary granulated carbon transmitter and automatic switch self-adjusting receiver lately put on the market. This instrument differs radically from any other on the market, inasmuch as by the automatic rotation the packing of the carbon granules is prevented, which has been the only fault found with that form of transmitter. The receiver automatically adjusts itself to changes of temperature, thus maintaining its best qualities constantly. The company claims to infringe no existing patents, which, in these days of patent litigation, is an important feature.

The Victor Electrical Company, Cleveland, O., is one of the flourishing electrical firms in a city which, as a centre for manufacturers and dealers in electrical material, stands in the front rank. Although comparatively new in this field, yet it has, in the line of progress and enterprise, already acquired a wide reputation. This firm issues each month a very creditable publication, containing principally a general line of second-hand equipments, both for electric railways and lighting. In addition to this part of its business, it handles several lines of new material, notably gears, pinions, commutators, bearings, trolley fixtures, instruments and electric heaters.

The Backus Water Motor Company, Newark, N. J., reports business for the past year as better than in 1894, and thinks the prospects for business for the Spring of 1896 are good. It has just completed a new electric ceiling fan, which, from an artistic point of view, it believes to be superior to anything yet produced. A special feature, which is new, is that there is a button at the bottom of the fan by simply turning which the fan can be run at one half speed, full speed or stopped. This is of great importance, and will be recognized as a selling card by the trade. In the gas engine department it has been quite busy, and the prospects are fairly good for future business.

The Water Circulating Grate Company, 1026 Filbert Street, Philadelphia, has recently received some gratifying letters of commendation. The Bridgeport Traction Company writes that since it has had the water grate put in its power station, its record has been most satisfactory, showing an amount of coal saved amounting to $4057.20 in six months. Messrs. McCallum & McCallum, of Philadelphia, write that the water grate has been in use in their works for three years, during which time it has in every way been satisfactory; a saving of coal has been effected and the capacity of the boilers increased, while the grates are apparently in as good condition as when built.

Edward S. Ford, 48 Wade Building, Cleveland, O., is the general agent for the Card Electric Company, of Mansfield, O., for Cleveland and locality. The multipolar motors, dynamos and power generators, manufactured by this company, are claimed to be the slowest speed standard machines on the market, and by reason of their massive proportions, stand a heavy overload. The company is also putting out a good many of its portable motors, specially adapted for machine shop and factory use. In addition to the above, its automatic safety limit switch and rheostat combined, its quick break pneumatic switch, and improved street railway fuse box, are well worthy of note.

The Ansonia Electrical Company, of Ansonia, Conn., is a pioneer in the electrical field, and the product of its factory can be found in every corner of the globe. Some of its specialties are: "Shield" brand moisture proof wire, "Weatherproof" line wire, all shapes and sizes of magnet wire, electrical house goods supplies of every description, including the world renowned "Diamond" carbon battery, bells, annunciators, push buttons, etc. Factory facilities are ample, insuring prompt shipments and lowest ruling prices. The officers of the company are Franklin Farrell, president; Thomas Wallace, Jr., vice-president and manager; Franklin B. Platt, secretary; L. F. Anschutz, treasurer.

L. F. Seyfert's Sons, 437 North Third Street, Philadelphia, dates its entry into the field of business from 1877, when the firm was established by William M. Seyfert, Sr., formerly of the Reading Iron Works (Seyfert, McManus & Co.), Reading, Pa. It engaged itself in the purchase and dismantlement of manufacturing plants which have ceased to operate for various reasons. This material is then put on the market in lots to suit buyers. Wood-working establishments, machine shops, electric light stations and steam plants, foundries, boiler works, etc., are particularly sought for. The personnel of the firm at the present time is William H. Seyfert, John M. Seyfert and Henry H. Seyfert.

The J. A. Fay & Egan Company, Cincinnati, O., is a firm whose history is coincident with the growth of the wood-working machine industry in the United States, the genesis of this company dating back to 1835. The first company actively engaged in the exclusive manufacture of this class

of machinery, it having from the start been the leading and largest manufacturers of it. Its line is the largest and most comprehensive of any manufactured, including machines for the complete equipment of the wood-working departments of car shops (both railway and street), planing mills, furniture, wheel and vehicle factories, shipyards, pattern shops, etc.; and in fact for wherever wood is to be worked in any manner.

JARVIS B. EDSON, 87 Liberty Street, New York, reports recent sales of the Edson steam pressure recording gauge at the following places: Kobe, Japan; Shanghai, China; Bombay, India, Buenos Ayres, Argentine; Santiago, Chili; Rome, Italy; London, England. That these and other foreign countries have had to send to New York for this appliance is conclusive evidence, both of its world-wide reputation and great value where steady steam or water-pressure is desired or where coal is to be saved and safety secured. It is needless to say that the appreciation met with in America is by no means less than abroad, and electric light and power plants form a large percentage of the purchasers of the instrument.

THE CHAS. E. GREGORY COMPANY, of 47 Jefferson Street, Chicago, through its manager, Mr. A. Louis Kuehmsted, reports business better than ever, which is saying a great deal for this live concern. Bargains in guaranteed electrical machinery that has seen some use is its specialty and it always carries a large and very complete stock of dynamos and motors of standard makes, of all kinds and sizes, as well as arc lamps, instruments and supplies. This house has earned an enviable reputation for square dealing, and the title "The Electrical Bargain House," is well merited. A repair department has recently been added, and it proposes to make this the largest and most complete repair shop in the West.

THE PERU ELECTRIC MANUFACTURING COMPANY, of Peru, Ind., is to be congratulated upon the reputation for high standard of excellence and superior workmanship which their goods now enjoy throughout this country. It is the original manufacturer of the "Laclede" and "Hercules" batteries. Its "Laclede" battery now has a reputation both for efficiency of service and cheapness unsurpassed by any other battery on the market. This company started but a few years ago to manufacture porcelain for the electrical trade, and it is now one of the largest manufacturers in this line. Its "Tablet" board, "Peru" rosette and 500-volt fuse motor cut-outs are standard and popular goods throughout the trade.

FRANK S. ALLEN, 136 Liberty Street, New York, successor to the Electric Boat Company, has achieved a really portable propeller for boats, applicable to any boat of 18 feet or less, and which can be shifted at will from one boat to any other. Movable in every direction, it can be used in the shallowest as well as in deep water, which no other propeller can. Even a child can run a boat backward, forward, fast or slow, and steer by its use. The motor, propeller and rudder (all in one) weighs but 35 pounds, and the four batteries used for power but 25 pounds each; the latter are, therefore, easily handled, and can be placed separately or together in any part of boat, and recharged with but little trouble.

C. C. PECK, 39 State Street, Rochester, N. Y., manufactures the Peck-boiler, which embodies in a shell boiler the principles of circulation embraced in horizontal water tube boilers, is designed for carrying the highest pressures required by quadruple expansion engines, and is built in sizes up to 300 horse-power and over. Both as an externally and internally fired boiler, this boiler is giving more than usual satisfaction to users, and is especially adapted to electric lightning and power work on account of having great reserve power and maintaining high economy through a long range of capacity, and on account of enduring hard forcing without injury and without increase of moisture in the steam.

THE MURRAY IRON WORKS, of Burlington, Ia., is one of the oldest concerns of its class in the West, as it began business in 1870 and has been continuously in operation ever since, and under the same management. Its plant consists of a foundry, the largest in the West, a new boiler shop with the latest power tools and appliances and a large and well-equipped machine shop. It employs hydraulic power, compressed air, steam and electricity in its works and spares nothing that aids in the production of good work at low cost. Its product is architectural ironwork in all of its forms, boilers for power and heating, steam engines, sawmills, etc., which goods are fully described in the various catalogues issued by the company.

THE GRAHAM EQUIPMENT COMPANY, of Boston, among other specialties has introduced its new steel-framed cars, which are made both open and closed. These cars possess many superior features over the present method of separate car body and separate truck. They are three tons lighter, six inches lower and many times stronger. The low feature of these cars is particularly desirable in Summer, enabling passengers to get in and out easily and quickly. Graham's steel I-beam truck is too well known to need further comment. It is simple, strong and equipped with Graham's equalized brakes. Graham's steel snow plow, which has been in service for the past three Winters, requires no motors or extra crew, and is always ready for service.

THE FAIRBANKS COMPANY, 311 Broadway, New York, is making a specialty of its asbestos disc globe valves, and asbestos seat gate valves for high-pressure steam, for use in power-houses and electric light plants. The exacting conditions of modern steam practice demand the best valves obtainable, and it is for this class of work that the Fairbanks valves are particularly designed. It is also of the greatest importance that no stoppage or breakdown should occur in any important plant, and for this reason the readily renewable discs and seats of the Fairbanks valves are especially desirable. This company has also designed special scales for use in boiler rooms in connection with coal-handling machinery, so that all fuel used may be accurately weighed.

THE WARREN ELECTRIC SPECIALTY COMPANY, Warren, O., believes it is one of very few manufacturers of incandescent lamps which has been able to carry on the business at a profit during the last three years. It has been fortunate in escaping patent litigation with the General Electric Company, and during the panic operated its factory night and day the year round. This we understand is not necessary at the present time, as it has increased its facilities to such an extent that it is able to manufacture six thousand per day now when pushed to the limit. The factory is under the management of Elmer W. Gillmer, secretary and treasurer, with F. E. Cavanaugh, superintendent, and at the present time is being operated with a full complement of orders.

W. C. STERLING & SON, dealers in cedar telegraph, telephone, electric light and street railway poles, ties, crossarms and pins, located at Monroe, Mich., where the largest pole yard in the world is located, have just closed the most successful year in the history of their business. The remarkable success of their business, due largely to the good quality of the material they furnish, as well as prompt dispatch, which is their principal card, have caused them to extend the scene of operations, and they have established seven different sorting and piling yards in the northern part of the State, from which shipments are made direct. During the past year they have had no shipments culled, and their record is one of which they may justly feel proud.

THE FIBERITE COMPANY, Mechanicville, N. Y., reports a very large addition to its year's business from the sale of the Medbery station and pony switches. The continued and growing demand for the Medbery overhead railway material necessitated large additions to the already extensive manufacturing facilities of the company, and in making such additions it was decided to provide room for the manufacture of a complete line of switches, switchboards, etc. The name of "Medbery" being a guarantee of the highest class of material, orders came in at once from all parts of the country, The determination, always adhered to, of making the highest class of goods at the lowest price consistent, has made the Fiberite Company successful in all its ventures.

J. H. MCFARLAN, Flint, Mich., manufactures telephones of the Hunnings type of transmitter, guaranteed not to pack. He has one arranged for exhibition at his factory that can be distinctly heard at a distance of 40 feet from the receiver. He considers this of no commercial value, but rather a disadvantage. The instruments that he sells are arranged to be used by placing the receivers to the ear, as in the ordinary phone. He claims for his instruments the desirable qualities of simplicity, reliability, clearness and loudness of tone. All nasal and barrel sounds are overcome. A whisper is faithfully transmitted. The furthest distance that the whispering qualities have been tested is 65 miles, with no apparent diminution of sound. He says the outlook for 1896 is good.

THE H. T. PAISTE COMPANY, INCORPORATED, manufacturers of electric specialties, Thirty-first and Ludlow Streets, Philadelphia, has issued a plain, but neat, and handy pocket catalogue 3½ x 8 inches, containing 32 pages, descriptive of the various designs and sizes of switches, cut-outs, sockets and various other specialties manufactured by this company. The "Xentric" single, double-pole and three-point switches, also the "Xentric" flush switch and the Paiste double-push switch, are all well-known to the electrical trade. The company sells direct to the wholesale trade only. Eight years ago Mr. Paiste commenced the manufacture of switches in Philadelphia in a small way; to-day the Paiste specialties are known all over the world as standard goods.

THE OSBURN ELECTRIC SUPPLY COMPANY, 296 Dearborn Street, Chicago, is meeting with much success with its new conduit, which is absolutely fireproof and possesses the highest insulating properties. It consists of galvanized tubing into which is placed porcelain bushings of the proper diameter and about six inches long, which are held together by the steel tubing. The elbows are also lined with this ceramic material. The company, which also manufactures a number of other electrical specialties and carries a complete stock of electrical supplies, has had a flourishing business during the past year. It now occupies an entire store and basement, having largely increased the size of its quarters. It has also the agency for the Warren Electric Specialty Company, Warren, O.

THE TAYLOR ENGINE COMPANY, Chambersburg, Pa., manufacturers of the well-known "Taylor-Beck" automatic engine, reports a very fair business the past year, having booked a great many duplicate orders, running into units of as high as 300 horse-power. The "Beck" engine is a good one, and has kept pace with the times, and is well adapted for direct-connected dynamo duty, on which the company are driving. The plant of this concern is one of the best equipped for engine and boiler building in the country, and with ample ground space for additional buildings. The Taylor Company has ever made quality a first consideration in all of its products, both in construction and operation, and are among the pioneers in the high-speed engine field.

THE CUTLER-HAMMER MANUFACTURING CO., Chicago, has for years made a special study of the rheostat, which plays such an important

part in the adaptation of the electric motor to the almost endless variety of uses to which it is now put. To properly adapt the controller for regulating speed and direction of rotation, under all of the conditions of motor work, requires high-class electrical engineering ability, long experience and honest work. The Cutler-Hammer Company has brought out numerous designs to meet these various conditions, which have become recognized by motor manufacturers as a standard of excellence. The company report a prosperous business for the year, and are in better shape than ever to supply their high-class rheostats to the trade.

The Pratt & Whitney Company, of Hartford, Conn., report that in 1895 its business has exceeded that of any other year of its existence by nearly $300,000. Bicycle and firearms makers at home and abroad have taken a liberal share of the output, but the sales indicated a general improvement in business of manufacturers in other lines. During the year the company has brought out an entirely new automatic weighing machine for granular material, so constructed that it is impossible for material to pass through the machine without being weighed correctly and correctly registered. A commodious blacksmith shop has been added to the plant, as well as a two-story addition to the shop of the small tool department. The business prospect for 1896 is bright.

J. E. Rhoads & Sons, Wilmington, Del., have their belt factory thoroughly equipped and manned to make first-class leather belting up to 72 inches in width. Their "Gilt Edge" brand is made short lap, very solid and of extra weight. They offer it in competition with the best, and comparative tests that have been made for stretch and strength give them confidence that it can stand on its merits. Their "Volta Dynamo" belt is of superior construction, and is treated with an unguent specially adapted to give pliability, durability and adhesiveness. They manufacture also a superior bell-cord, their "Tannate" brand, and numerous handsome styles of hand-straps for street cars. For these they have a new fastening to replace the clumsy doubled and riveted joint.

The Jeffrey Manufacturing Company, Columbus, O., which has made the name "Jeffrey" synonymous with successful power coal-mining machinery as well as other labor-saving appliances, reports that in the past year the growth of the Jeffrey specialties has been very marked, the demand for the same extending over the entire country, as well as in foreign lands. In keeping pace with this demand the Jeffrey Company has largely increased its facilities for manufacturing, and has to-day a plant second to none for manufacturing such specialties. Among them will be found the latest improved Jeffrey chain coal cutters, coal drills, mine locomotives, coal-handling machinery, chain and steel cable conveyers, as well as coke and coal crushers, all of which are fully up to date.

I. P. Frink, 551 Pearl Street, New York, manufactures improved patented reflectors and reflecting chandeliers for churches, theatres, halls, art galleries, and for general use where economy of current and abundance of light is desired. He has installed his reflectors in hundreds of the finest churches and theatres in all parts of the country; in the best art galleries, such as the Metropolitan Museum of Art, New York; Art Institute, Chicago, Ill.; Carnegie Library, Pittsburg, Pa.; in the finest private art galleries, such as George W. Vanderbilt's, Elbridge T. Gerry's, New York; James W. Ellsworth's, Chicago, Ill.; L. Z. Leiter's, Washington, D. C.; Joseph Jefferson's, Buzzard's Bay, Mass.; in many office buildings and stores where they wish to make a feature of the lighting.

The Garton-Daniels Electric Company, Keokuk, Ia., is convinced, from the letters being received almost daily from some of the largest street railway and electric light stations throughout the country, that its claims for the superiority of the Garton lightning arresters is confirmed. Making the lightning arrester business a sole specialty, it feels that it is in a better position to equip a plant to give perfect protection than any other concern on the market. The Garton arresters are made for all purposes, for use in any place, on any kind of circuit, either street railway or complete metallic, of any voltage, amperage, and any kind of current. They have been adopted by many of the leading independent manufacturing concerns and are being sent out with manufacturers' equipments.

Edwards & Co., 144th Street, New York, are putting on the market, among other specialties, a new gas-lighting key. It consists of a raised metal block and two "New Mite" desk pushes for each burner. A desirable innovation in these articles is the use of concave and convex centres in the place of the old-style black and white. They are well made, handsomely finished and compact. The demand for this firm's well-known door and window springs, desk pushes, annunciators, burglar alarms, patent clip switches, etc., is constantly increasing. Their Lungen "buzzer," being so small and well made, is admirably adapted to and largely used by telephone manufacturers as well as the regular trade. For the telephone trade they are also making a small relay, wound to any resistance.

The Novelty Electrical Supply Company, of Williamsport, Pa., is the pioneer electrical construction company of that beautiful city on the west branch of the Susquehanna River. Williamsport is a bustling city of about 40,000 inhabitants, and some of its varied products reach nearly every market in the civilized world. The Novelty Electrical Supply Company began business in electrical contracting in 1890, and to-day it has its own shops and builds its own dynamos and motors and other electrical apparatus and specialties, and has quite a number of isolated plants in successful operation in various parts of the state and in Williamsport. At present the shops are working 15 hours a day to keep up with orders. Mr. F. H. Ward is the designer, electrician and business manager.

The Commonwealth Electric Construction Company, of Philadelphia, has removed to its new and enlarged factory, 233 South Fifth Street, on a lot 25 feet front by 151 feet deep, the building being a three-story brick. The company has largely added to its machinery, will generate its own current with "Commonwealth" dynamos, and run its machines with the "Commonwealth" electric motors, distributed throughout the plant. The business of the company has been steadily increasing, compelling its removal to its present commodious quarters. The officers are: Louis B. Henry, president; Howard Whelen, treasurer, and Howard Bucknell, secretary. Philip A. Mehan, Walter W. Hartel and Edward A. Jenkins are in charge of the electrical and construction departments.

Charles H. Barrows, of Willimantic, Conn., will soon place on the market his "Motor Vehicle," which, it is claimed, will be the most simple and easily managed motor vehicle in the world, and the cheapest, the prettiest, the handiest and the only one that not only equals, but is superior to a horse and buggy for all business and pleasure purposes every day in the year, whether it is wheeling or sleighing, on roads that are hilly, muddy, sandy, or on level asphalt pavement. The machine will not have a gear, crank, sprocket, chain, or belt or clutch. One hand on the lever will start, stop, steer and control the speed, and the utilization of the power is so advantageous that one half horse-power and a total weight of machine over 500 pounds with the storage battery are all that will be required.

The Campbell & Zell Company, Baltimore, reports present business and future prospects good. Among duplicate orders it mentions a fourth order from the Maryland Electric Company, Baltimore, of 560 hp; a fourth order from the City & Suburban Railway Company, Baltimore, of 754 hp; a third order from the William Henderson Sugar Refinery, New Orleans, La., of 500 hp; also one of 500 hp from the St. Charles Hotel, New Orleans; one of 300 hp from the Botsford Paper Mill Company, Kalamazoo, Mich., and one of 600 hp for the new Olympia Theatre, New York. It has also just installed a 117-hp high-pressure boiler to work at 200 lbs. pressure for the Baltimore Chrome Works, and several days ago received an order from the Richmond, Va., Traction Company for 500 hp of boilers.

The India Rubber & Gutta Percha Insulating Company held a pleasant reunion on New Year's Eve at its offices in Cortlandt Street, New York. Every one fortunate enough to be interested in wires and cables received a cordial invitation from Messrs. J. W. Godfrey, F. W. Harrington and J. B. Olson to be present, and was assured that every precaution had been taken to make the celebration of "Red, White and Blue" a success, and that no danger need be anticipated from "overloading," as direct connection with the Ambulance Corps, by special Habirshaw "wires" had been made. Mr. Habirshaw was present and made a careful analysis of material to be used, making sure that nothing but "Pure Para" was placed before his guests. It was the unanimous opinion of those present that all connected with Habirshaw wires were royal entertainers.

Abraham L. Bogart, of 22 Union Square, New York City, has been prominently identified with electrical interests, both as an inventor and manufacturer, for over thirty years. He has made a specialty of the application of electricity to gas-lighting purposes, being the first to put such apparatus on the market in commercial form. The system devised by him is to be found in almost every theatre, church and hall throughout the United States. He is also the manufacturer and proprietor of the famous Bartholdi automatic, and of the dynamo-electric torch or hand-lighter. Mr. Bogart further produces and deals in a large variety of ingenious devices and supplies as adjuncts to the gas-lighting and electrical business, and engages as contractor in electric light, motor or other similar work for the various electrical installations.

The Bliss School of Electricity, Washington, D. C., is the only institution in the country where electrical engineering is exclusively taught in a thoroughly practical manner. To meet the rapidly increasing demand for men trained in the technology of electricity this school was created. Its name indicates its purpose—it is a workshop of practice in everything connected with electricity. The institution is designed to turn out men who are in every sense of the word "experts." The course is planned with the view of practically gleaning the science from all branches of electricity, together with a line of laboratory work, including all apparatus of latest design, excluding all foreign languages, fine arts and higher mathematics, thus giving a thorough course in pure and simple applied electricity. The course is complete in one year.

The Hays, Tracy, Fyfe Company, 358 Dearborn Street, Chicago, is much gratified with the reception of its motor-starting and motor speed-regulating rheostats, city authorities and boards of underwriters having been unanimous in pronouncing the apparatus entirely satisfactory. Among the points most appreciated is that there are no fine wire magnets to make the action unreliable. The patents protecting the rheostat cover broadly the fire-proof porous insulation used, the peculiar type of magnetic contacts and precise automatic release, and the automatic

method of protection from burn-out. An automatic double-pole switch attachment is added when desired, which works automatically with the contact arm, throwing the fields in circuit just ahead of the armature, and throwing the armature out just ahead of the fields.

MUNSON BROTHERS, Utica, N. Y., are convinced that it is a well-established fact that the power developed from a turbine water-wheel, taken from every point of view, is the most satisfactory power that can be had for any class of work, and is particularly desirable for electric-lighting and power-producing plants. This power can be produced at a very slight expense and is very reliable when the right wheel is used. Munson Brothers claim, after a careful consideration of the merits of the different makes of turbine wheels now on the market, that for percentage of power produced from a given amount of water, and for durability, there is no wheel equal to that manufactured by it, the well-known "Little Giant," and they will be glad of the opportunity of substantiating the claim to any one who contemplates putting in a power of the above description.

THE FERRACUTE MACHINE COMPANY, of Bridgeton, N. J., which makes a specialty of presses and dies for sheet and bar metals, states that business was dull the first half of the year 1895, but since July 1 the works have become quite busy, being compelled to run overtime in order to keep up with orders. This is partly accounted for by the activity in the bicycle trade, for which it builds some special machinery. All of its presses have been recently improved, and several new ones have been placed on the market, so it feels it is in a good condition for trade in 1896. The Ferracute special automatic notching machine has recently been redesigned. As now arranged, it notches armature discs at the rate of 200 notches per minute. It has also made the necessary attachments for some of its power presses to enable them to be driven by electric motors.

THE FITCHBURG STEAM ENGINE COMPANY, of Fitchburg, Mass., whose engines have for years stood very high for workmanship and economic results, has within the year applied an entirely new method of moving its steam valves, simplifying and reducing by 90 per cent. the work of moving the valves, and securing a better steam distribution. It is making low-speed engines from 1200 horse-power down, cross or tandem-compound condensing, or high-pressure single cylinder, either horizontal or vertical, and also first-class high-speed engines. Features of these engines are economy and simplicity, with such regulation that electric light and railway service have been supplied at the same time from the same engine. The company has been running full time and with full number of men through the hard times, and now has several weeks' work in hand.

THE NILES TOOL WORKS COMPANY, Hamilton, O., with the object of facilitating repairs to the running gear of electric cars, has gotten out a special equipment, consisting of an engine lathe, car wheel borer, drill press, hydrostatic press and gear cutter. All of these tools are of the very best, heavy and substantial, quickly and easily manipulated, and such as can be operated with the minimum of repairs. Special attention has been given to see that all the parts are so designed and constructed that the machines will not be continually laid up and thrown out of use on account of breakage of one or more of the parts, which is of special importance for urgent cases. All of these machines are fitted, if desired, with electric motor drive. A special catalogue on this subject gives information of general, as well as of particular interest to the electrical public.

B. J. ARNOLD, Chicago, formerly consulting engineer of the Intramural Railway at the World's Fair, has been engaged during the past year upon a number of important engineering contracts, among them being several electric railways located in different parts of the United States. Probably the most interesting plants which he is engaged on are those of the Chicago Board of Trade, in which storage batteries working in conjunction with electric elevators will be used. Also the Englewood & Chicago Electric Street Railway, which will use storage batteries for the propulsion of cars. The results of these two plants will be watched with interest, as they are both radical departures from the present standard systems. Mr. Arnold has the courage of his convictions in carrying out his ideas when once having become convinced that economy can be effected by changes.

THE EDWARD P. ALLIS COMPANY, Milwaukee, Wis., has its shops busy in all departments. Among the engine work on hand are 12 pair of compound duplex blowing engines with steam cylinders 40 and 78 inch diameter, 5-foot stroke, and it also has orders on its books for a number of other blowing engines. A number of engines are being built at present for street railway companies, the West End Street Railway Company, Boston; Consolidated Traction Company, Newark, N. J.; Los Angeles Railway Company, Los Angeles, Cal.; Louisville Railway Company, Louisville, Ky.; Albany Railway, Albany, N. Y., being among the number. There are also in hand a number of orders consisting of hoists, power engines and air compressors from South Africa. The mining department is busy on orders for machinery from the mining districts in this country and Mexico.

THE OHIO BRASS COMPANY, of Mansfield, O., reports a most satisfactory year's business, and the outlook for the ensuing year is more than encouraging. The establishment of several branch offices, and the adding of many domestic as well as foreign agencies, have resulted in largely increasing its sales, which have doubled in amount during the past year over the previous twelve months. This company, always on the outlook for new and important devices of utility, have added to its line recently a number of special articles, all of which are already largely in use, and in many cases have been adopted as standard articles by many of the electric roads in this as well as in foreign countries. Its manufacturing plant, which consists of a foundry, and thoroughly equipped pattern and machine shops, has been enlarged and its capacity increased by the addition of new machinery and tools.

THE MARVIN ELECTRIC DRILL COMPANY has completed the equipment of its new factory, Canastota, N. Y., and is now turning out electric rock drills and dynamos of an improved type. The recent machinery built by this company embodies a number of substantial improvements that tend to prolong the life of the apparatus. The company has recently brought out an intermediate size of machine, particularly designed for underground work. The machine is readily handled by two men, and is of sufficient power to make rapid progress in drilling the hardest kinds of rock. The many different sources from which the company has received inquiries about its electric drills, including over a dozen foreign countries and nearly every State in the Union, indicates that the interest in the electric percussion drill is almost universal in mining circles. Many flattering testimonials are being received by the company.

THE COMMERCIAL ELECTRIC COMPANY, of Indianapolis, Ind., well known as the pioneer in the use of forged iron for the entire magnetic circuit of dynamos and motors, has during the past year brought out a line of multipolar generators and motors, with which it has met with remarkable success. A large number of street railway power-houses, municipal and isolated lighting plants have been equipped, and the contracts on hand will keep its large factories busy for several months. These machines were designed by Mr. M. O. Southworth, the company's electrical engineer, formerly with the Thomson-Houston Electric Company in the same capacity. They differ from the general type of multipolar dynamos in the use of smooth-core, gramme-ring armatures instead of the iron-clad type. The company claims superiority of regulation, high efficiency and entire freedom from sparking as the results.

THE BERLIN IRON BRIDGE COMPANY, East Berlin, Conn., calls attention to the patent circular coal pocket, manufactured exclusively by it. Where provision has not been made in power-houses for the storage of coal over the boilers, this circular coal pocket furnishes a means for the storage of the fuel outside of the building in a most convenient and economical manner. The pocket is constructed in a cylindrical form, thus occupying a minimum area. The frame consists of a centre post, surrounded by a series of posts on the circumference of the cylinder, all thoroughly braced together. The outside posts are surrounded by adjustable metal hoops, with a lining of plank. It can be built with or without a roof. An endless variety of constructions can be designed to meet the various requirements, both as to dimensions of the coal pocket and the machinery for unloading and delivering the coal.

THE NATIONAL INDIA RUBBER COMPANY, of Bristol, R. I., has for a number of years manufactured, under the careful supervision of Mr. Fred S. Minott, a very high grade of insulated wires, and to-day the trade name "N. I. R." is familiar to every purchaser of standard insulation. "N. I. R." has the absolute approval of the National Board of Fire Underwriters, and for efficiency, durability and finish is without an equal. The utmost care is exercised in every stage of manufacture; men of more than thirty years' experience in the manipulation of rubber are employed; the mechanical and electrical tests are as thorough as severe, and the finished product is perfect. During the Summer, extensive alterations and additions were made to the plant, and the firm is now prepared to execute contracts of any magnitude. It will, shortly, open an office in New York under the management of Mr. Henry D. Stanley.

THE SAMSON CORDAGE WORKS, 115 Congress Street, Boston, Mass., has during the past year met with much success with its "Samson" solid braided cord, which has now become a recognized standard device for the suspension of arc lamps, and is no less in demand for street car trolley cord and armor cord for covering magnets of dynamos. A special waterproof finish is applied, unless otherwise specified, which increases the durability of the cord considerably, and strongly recommends it for all outside service. The cord is made of cotton, linen, or Italian hemp. The cotton cord is, however, more commonly used, and is probably quite as durable as either of the others. In order to protect its customers against the substitution of low-grade cord, a distinctive mark has been provided, and "Samson spot cord" is marked with a series of colored spots, which has been adopted as a trade-mark.

THE WAGNER ELECTRIC MANUFACTURING COMPANY, 2017 Locust Street, St. Louis, will call a stockholders' meeting to consider the question of increasing the capital stock from $100,000 to $250,000 and of using part of this to extend the building over the ground in front of the present factory, which will more than triple the floor space. The company is about to issue a complete catalogue of high potential, non-arcing, carbon-break switches, and is going to enter largely into the manufacture of superior grade switches and switchboards, believing that the average switch is sold at a rating beyond its capacity and that most of the resistance and trouble in switchboard construction is due to the poor apparatus furnished in the

switch line. The large demand for Wagner transformers this Fall has necessitated working day and night for over a month, and during December the force worked three nights in the week until 9:30.

The National Water Tube Boiler Company, of New Brunswick, N. J., having been thoroughly reorganized in May last, started the present year with bright prospects, and owing to its growing business found it necessary to call together its shareholders on Sept. 5 to decide about an increase of the capital stock, which was promptly agreed to, 95 per cent. of the shareholders voting for the increase from $100,000 to $200,000. The present management has but one purpose in view—to push the "National" boiler, the outgrowth of years of careful thought and experience, to the front rank of water tube boilers. The large number of second and third orders speak for themselves as to the merits of the "National." The following gentlemen are the officers and directors: Mr. James Deshler, president; Mr. Warren A. Greene, vice-president; Mr. John C. Evans, treasurer; Mr. Edw. Tindell, secretary, and Mr. Joseph Fisher, director.

J. Jones & Son, 67 Cortlandt Street, New York, are doing a good trade in their line of knife-switches, just introduced, which is one of the neatest and most compact for carrying capacity now on the market. Of cut-outs the firm has a good assortment. One of the articles which they have advertised considerably of late is their new wire-winder, for winding wire into good neat coils. Everybody in the supply business needs something of this kind and unquestionably no better one is made. A neat compact fire-alarm box for large buildings is also an addition to the specialties they manufacture. In addition to the above the following articles have also been made in large quantities: Electric portables, dynamo brushes, crowfeet for electric fixtures, "Perfection" medical batteries, "Perfection" electric alarm clocks and Leclanche battery zincs. The business of the firm has rapidly increased in the last two years.

The Chicago General Fixture Company, 169 Adams Street, Chicago, is practically a new concern in the electrical supply business. It was started originally for the purpose of manufacturing and selling electric light and combination fixtures. The addition of supplies to its business was forced upon it by the constant demands by its customers for all kinds of fixtures and supplies to meet their wants. To meet this demand the concern has put in a full line of standard electrical supplies of all kinds, and has been so successful in getting its share of the trade that more commodious quarters have been engaged for the beginning of the year. A new electric supply catalogue is now in hand, and will be issued early in the year. Mr. Overbagh, general manager of the company, is one of the pioneers in the electric light business, having served his apprenticeship with the old Weston, United States and Edison companies.

The "W. & S." Hydraulic Machinery Works, 204 East 43d Street, New York, is an example of the vast growth and development of the hydraulic press industry, much of which is due to the development of the electrical field. The old and ancient press, which worked so slow that the motion of the ram could not in many cases be discerned, has been gradually superseded by the light and quick-working press, driven by pumps designed for the special duty required, capable of performing many operations per minute, and thereby so increasing the daily product of the tool as to become a profitable acquisition in thousands of shops. For die work, such as hard rubber trimmings, plastic material of many kinds, and for forcing armatures and similar work, requiring a heavy pressure, nothing known to-day can equal the hydraulic press. A full line of this class of machinery is manufactured by Watson & Stillman, whose initials form part of the firm name.

The S. S. White Dental Manufacturing Company, Philadelphia, invite the attention of electricians to a wet battery of high voltage and ample amperage, for which the claims are made that it can be charged without the handling of acid solutions; that it automatically makes its own electropoion fluid, and only as used; that its current is practically constant until the exciting fluid is used up; and that it can be fed from time to time at a nominal expense, and its current kept at a maximum without the necessity for refilling. The Partz acid gravity battery is the one referred to. The same firm manufactures a full line of dental electrical appliances, and its special field is in heavy open-circuit work, as telephones, especially long-distance lines, annunciators, electric clocks, signal bells, etc. The basis of its action is the Partz sulpho-chromic salt, an amorpho-crystalline compound, with which also an unequaled electropoion fluid can be made for other forms of batteries.

The Indianapolis Electric Company claims to have the largest stock of electrical supplies in the State of Indiana, embracing all the different styles of the well-known Paiste switches, Bryant and Sawyer-Man goods; also Hart switches as well as the different styles of standard Edison supplies. In its stock will be found the well-known Packard and Columbia lamps, the Interior Conduit & Insulation Company's brass and iron armored conduit, street railway material, with combination switches, caps, cones, bodies, ears, etc.; everything, in fact, pertaining to a general line of supplies, including domestic electrical supplies, electric light, both arc and incandescent supplies and apparatus. The company has been in existence practically about 2½ years, but in that length of time the demand for a well-equipped supply house in Central Indiana has so largely increased its trade that but recently it was compelled to enlarge both quarters and stock.

Charles A. Strelinger & Co., Detroit, Mich., points with pride at the wide fame of its firm, as again recently demonstrated by the demands for the latest edition of its "Book of Tools." None were sent out except on applications accompanied by postage, but during the last year 20,000 have been called for, with, it is needless to say, a large and satisfactory return in the way of orders. A second edition of 50,000 has been printed, and, at the rate at which they are now going out, a third edition will soon be necessary. About the first of September a catalogue called "Tools and Tool Chests" was issued and distributed exactly as the other book named, and the success which it has met with has also been very gratifying. The trade during the past year from these two sources has been phenomenal, and as each order or reply after receiving the catalogue has been accompanied by letters highly complimentary, the company feels in splendid humor for the beginning of the new year.

The Viaduct Manufacturing Company, of Baltimore, Md., on the day before Christmas celebrated the occupation of its new works by the raising of a 20-foot flag on a 75-foot pole. The flag was the gift of the employees of the company, and a presentation speech in their behalf was made by Mr. Carroll Miller, of Baltimore; Mr. Augustus G. Davis, president of the company, responding with a few words of acceptance and good cheer for the employees. To further celebrate the event, the employees were given a holiday until Friday morning. The reconstructed works are on a larger scale than the plant that was burned last June, the principal buildings covering spaces 100 x 40, 200 x 48 and 68 x 48 respectively. In addition, there are a dry-house, forge and office building, all of brick, and also lumber sheds. The company owns 25 acres of land along the river front, and the whole plant is run by water power, a gas engine being provided for emergencies.

Harold P. Brown, 68 Broad Street, New York, is much gratified with the excellent success he has experienced during the past year with the plastic rail bond, as well as gratified with the prospect for the new year. A large portion of the Winter's work has been in supplying material for rebonding old roads, which have found the best copper bonding insufficient even when in good condition. On the Cleveland Electric Railway, for example, the plastic bond has been substituted in places for two sets of copper bonds, one of No. 0000 passing around the chair of the web rail, the loss with the latter during heavy loads running from .08 to .35 volts per joint. After the plastic bond was applied the drop was but .015 volts per joint at the time of the heaviest load. The Buffalo Railway Company has decided to use the plastic bond material for all unsoldered copper contacts, on dynamo switches, bus bars and instruments in the power house, on all unsoldered connections on the motor cars and on all line switches and cut-outs.

McLeod, Ward & Company, Thames Building, New York, numbers among its electrical specialties the Kinsman desk and portable fixture, and of the many devices brought out for shading and concentrating the rays of the electric light none seem to have met with better success. It has been a common sight to see pieces of paper and other crude devices tied to the regular shades in the attempt to shield the eyes, especially in buildings where the electric light is used all day. This trouble has been entirely overcome by the Kinsman fixtures. For the convenience of buyers agencies have been established in different sections of the country, as follows: McKinney & Waterbury, Boston, Mass.; W. H. Glenny, Sons & Company, Buffalo, N. Y.; Central Electrical Company, Chicago, Ill.; Thos. Day & Company, San Francisco, Cal. Messrs. McLeod, Ward & Company, also manufacture the well-known safety insulators and Ward spark arresters, for both of which the demand is quite brisk at this season.

Morse, Williams & Company, Philadelphia, who build all kinds of passenger and freight elevators, have made very extensive improvements in their plant at Frankford Avenue, Wildey and Shackamaxon Streets, during the past year. They have erected a large shop especially adapted to the construction of hydraulic elevators, and have added two stories to their wood-working department, and also built a large three-story building adjoining it, and put a new blacksmith's shop on the site formerly occupied by the stable, having built a new stable in the vicinity of their works. These improvements add very largely to their facilities for constructing electric elevators, in which their trade has very rapidly increased with each succeeding year since their machine of that type was put on the market. A large addition to their wood-working department gives them much better facilities for building fine passenger elevator cars. They have branch offices in New York, New Haven, Boston, Baltimore, Pittsburg and Scranton, Pa.

The Standard Underground Cable Company, Pittsburg, Pa., reports that its business for the past year has been extremely satisfactory, the output being about the same as for the two years previous, during which time its factories have been running day and night in order to supply the demand for insulated wire and cable. While large figures are usually looked upon with more or less suspicion, when based upon actual facts they become exceedingly interesting and noteworthy, and the following ones come in the latter category. The colossal installation of underground feeder cables for a large traction company in the City of Philadelphia, upon which the Standard Company has been constantly engaged for

nearly three years past, and which it has just completed, amounted to a total of 2,054,670 feet of cable (lead-covered, ranging from No. 0000 B. & S.G. to 1,000,000 C. M.); also over 600,000 feet of duplex telephone cable. The total weight of this cable is 9,050,000 pounds, or 4600 net tons. The Standard Company believes the outlook for 1896 to be quite favorable.

THE STANDARD ELECTRIC COMPANY, of Chicago, through its poet, reports as follows: "The natural outcome of a year of prosperous contracts is an air of elation, a joyousness that stimulates to renewed endeavor. It requires but a momentary glance at the pages of our order book to realize that from the Atlantic to the Pacific, and from the land of snow and ice to the jasmine and the orange blossom, Standard arc lamps are shedding their perfect light in street and store, making plain the path of the wayfarer and enriching the bargains of the merchant. Towns that had experienced only the desolation of darkened streets awoke to the advertising values of the properly lighted thoroughfare long before the necessity and economy from a sanitary and moral standpoint of clearly illuminated streets became apparent. And with the advent of the simple and efficient Standard lamp property values in many a town have increased, the ambitious youth no longer seek more promising fields and a general air of prosperity has displaced the gloom that indicated stagnation and its accompaniments, poverty, death."

THE FLEMING-SPENCE ELECTRIC COMPANY, 652 Hudson Street, New York, was formed during the past Summer to manufacture the Fleming arc lamps and other specialties designed by its president, Mr. R. Fleming, and has now on the market what is known as the Fleming alternating arc lamp. The officers of the company are R. Fleming, president; Thomas J. Fleming, manager, and William H. Spence, secretary and treasurer. They are all young men, though all have had considerable experience, both in an engineering and business sense. The president, Mr. R. Fleming, has had a most varied and valuable experience as an engineer in construction work, central station management and in the manufacture of electrical apparatus, and is fully conversant with the needs of the electrical field. Mr. Spence is new to the electrical business, though he has for a long time been extensively interested in an allied branch, namely, the leather business, both in New York and Boston. Mr. Thomas J. Fleming is well known in New York and the West, having been engaged for a number of years in electrical contracting and construction work.

THE ELECTRIC RAILWAY EQUIPMENT COMPANY, 431 Front Street, Cincinnati, O., reports that its business during the last year has been exceptionally good. Several new lines have been added to its standard line of manufacture, one of which is a new mast arm for electric light arc-lamp poles. This mast arm is of an exceedingly simple construction and overcomes a great many of the difficulties which have been met by the lighting companies in mast arms previously put upon the market, and flattering accounts have been received from the companies to whom they have supplied. These mast arms are operated with an automatic switch in their extreme end and have a very simple method of bringing the lamp to the hands of the trimmer, and also when placing in position. The contact has been found to be perfect and no trouble of any kind has been experienced in their operation. One of the companies using a large number of them reports that its men are able by the use of this mast arm to trim double the number of arms than with any other mast arms they have known, and they have tried almost every arm of other makes that have been placed upon the market.

THE WHITNEY ELECTRICAL INSTRUMENT COMPANY, Penacook, N. H., has found the year just ended the most prosperous, without exception, in the history of the company. Owing to the very large demand for its Hoyt ammeters and voltmeters of the switchboard type for alternating current, it has found it necessary to greatly increase its facilities, and is now enabled to turn out these instruments in any number at a minimum cost. There is also a very healthy demand for its portable instruments for alternating current, and one has only to read a description of these celebrated instruments to be convinced that our claims of superiority are well founded. To the already complete line of direct-current instruments has been added a switchboard instrument of the permanent magnet type in an iron-clad form, of which a large number has already been sold, the universal comment being that they give very satisfactory results. The Whitney Company has undertaken the manufacture of the Houston-Kennelly illuminometer, which was first announced at the January convention of the National Electric Light Association, and which is now made in an improved form.

THE PETTINGELL-ANDREWS COMPANY, of Boston, is probably as well known as any supply house in the United States, representing as they do the most prominent manufacturers of electrical goods in this country, among which are the following concerns: The Interior Conduit & Insulation Company, of New York; the Okonite Company, of New York; the Phillips Insulated Wire Company, manufacturers of the celebrated O. K. weatherproof wire; the Bryant Electric Company, of Bridgeport, Conn.; the Standard Paint Company, of New York; the Billings & Spencer Company, of Hartford, Conn., manufacturers of drop forged overhead trolley material and commutator bars. It is general selling agent for the United States and the Dominion of Canada for the last mentioned company, and is building up a large trade in this new drop forged overhead material, which is giving universal satisfaction. Aside from representing the above companies, it is doing a large business in electrical supplies of all descriptions, throughout the United States and foreign countries. Its business has almost doubled during the last year, and it hopes by continued efforts to retain its title of "Leading Supply House."

THE COLUMBIA ELECTRIC COMPANY, of Worcester, Mass., has been rapidly coming to the front in the installation of isolated plants and general construction work, in addition to its large electrical supply business. The following is work of the past few months completed or under contract: American Wheelock Engine Company, Worcester, 16-kw dynamo, with arc and incandescent lamps; Worcester Corset Company's new factory, 1000 light direct-connected dynamo and installation; Warren Thread Company, Ashland, 400-light plant; Riverdale Woolen Company, of Northbridge, 30-kw dynamo and 600 lights installed; J. W. W. Bishop & Company, the contractors, of Providence and Worcester, an isolated plant of 100 lights; Chas. Baker & Company, 100 lights; the new N. E. Telephone Building in Worcester (fire-proof construction) armored conduit; the Central Exchange Building; the renovated Joslyn House; a complete lighting plant for the Marshall Paper Company's new mill at Turner's Falls, and others. This company claims to be "the largest electrical house in Central Massachusetts," and as it manufactures dynamos and carries a large stock of supplies, is prepared to offer inducements to prospective purchasers.

THE STORAGE BATTERY SUPPLY COMPANY, 239 East 27th Street, New York City, was the first company established in this country for the regular supply of storage batteries on rental for all uses, from phonographs, kinetoscopes and sewing-machines to isolated lighting for special decorations. At that time the only extensive use of storage batteries as units was in the operation of phonographs. This field was at once covered, and since then the development has been steadily increasing, until now the supply of power for phonographs forms one of the minor branches of the business. When it became known that it was possible to have stored electricity delivered at any point, of any voltage or amperage required, the field was immediately developed. A few of the many uses to which the storage battery is put are decorations for balls, weddings, advertising, wagons, Christmas trees, for doctors' and dentists' instruments, theatrical work, carriage and yacht lighting. In the early experience of this company the storage battery was meeting with much disfavor everywhere. This was owing to the patent litigation that has done so much to retard the battery in this country; it was therefore an agreeable surprise to have a company enter the field to rent and maintain the battery in working order.

THE BRUSH ELECTRIC COMPANY, of Cleveland, O., during the past year has made a great specialty of the manufacture and sale of large arc dynamos. The electric lighting public are as familiar with the smaller Brush arc dynamos as with any other type. Since the company has brought out its large arc dynamos it has sold a total capacity of over 20,000 lights. This indicates that the buying public are becoming familiar with the new dynamos. The fact that so many Brush arc dynamos sold prior to 1880 are still running and giving good service leads purchasers always to consider the Brush arc dynamo when starting new plants or increasing their old ones. The Brush arc lamp holds its own on the market. Great improvements have been made in these lamps, and during the year 1895 more arc lamps were sold than in the previous year. The Brush Company estimates that for the fiscal year of 1895 its sales will have increased very largely over those of 1894. It is certainly to be congratulated on having, as pioneers, designed more than 17 years ago an arc lighting system which worked economically and satisfactorily, and was popular with the buying public, and to have improved that system as the years roll around so that to-day it is equal if not superior to any other type, notwithstanding the number of new minds devoted to improvements and the result therefrom.

THE ELECTRIC STORAGE BATTERY COMPANY, of Philadelphia, reports business to be in a very satisfactory condition and with excellent prospects for the future. The electric lighting department has been exceedingly busy, the following being some of the prominent contracts which have been completed or are now in progress: Central-station batteries for the Boooklyn and Lawrence Edison stations, aggregating 1400 kw-hours capacity; a battery of 190 kw-hours for the new court house at Minneapolis for use in connection with elevator and lighting service; batteries aggregating 715 kw-hours for isolated plants in the residences of C. T. Yerkes, New York; Frank Thompson, Merinea; Mrs. T. Harrison Garrett, Govanstown, Md.; Mitchell Harrison, Philadelphia, and Archibald Rodgers, Hyde Park, N. Y.; batteries aggregating 270 kw-hours for the Franklin and Harrison office buildings, in Philadelphia, and the German Liederkranz Society, of New York; a plant of 216 kw-hours for the Government buildings at Buenos Ayres, S. A. The Western Union Telegraph and the Postal Cable Telegraph Companies have installed several thousand chloride cells for telegraphic purposes, and many have been used in connection with fire alarms. During the year chloride accumulators have had extended and thorough tests in train-lighting work, and as a result are being used extensively in that service.

THE GATES ELECTRIC MANUFACTURING COMPANY, Monadnock Block, Chicago, Ill., is receiving many compliments for the fine finish, smooth operation, convenience in handling and compactness of the Gates dynamo. The 1000-light dynamo recently installed in the Stamford Hotel, Chicago, has been viewed by many electrical engineers and other

interested people, and declared by all to be one of the best machines they ever saw. On a test the regulation at different loads was found to be entirely correct. On full load the machine was found to be conservatively rated, the field coils rising in temperature to but 60 degrees F. above the air, while the armature showed but 65 degrees rise. The machine throughout showed careful designing, and that particular attention had been given the little conveniences desired by the operating engineer and usually disregarded by the dynamo builder. The Gates Company is now building four 100-kw 500-volt generators for the Indiana Railway Company, of Elkhart, Ind.; an 80-kw 500-volt generator for the Bloomington, Ill., City Railway Company; a 40-kw direct-connected dynamo for the Bellaire Stamping Company, Harvey, Ill., besides several 10-kw direct-connected dynamos for lake steamers. Numerous orders for small multipolars are being received, and a larger factory has become a necessity. Propositions have been received for the furnishing of grounds and buildings in various thriving towns, but the Gates Company will keep its factory in Chicago.

The Thomson Electric Welding Company, Lynn, Mass., has largely extended its electric welding processes, which nowembrace almost, if not altogether, the entire range of metal welding. An enumeration would be too extended for the space at disposal, but we may state that it has been applied to pipe-work, bicycle tires, tempering wire of all materials, forging spokes to tires of wheels, the manufacture of tools, such as axes, chisels, hammers, etc., pipe coils, boiler flues, boiler shapes, printers chases, gun projectiles, storage battery plates and many other uses. Its application to welding of street railways is, of course, well known. A field peculiarly its own is that pertaining to welding of non-ferric metals, such as copper, aluminum, etc., and the welding of the different materials, such as copper to iron. In many large factories throughout the country it is found that there may not be a sufficient amount of work of any one kind to justify the use of an electric welding machine, yet the total amount of welding of various kinds done in such a factory may be large; consequently there has been a demand for a machine which shall cover a variety of work, and to meet this requirement a "Universal" welder, now used, has been built. The question of jobbing plants to be installed in various places throughout the country is one which has created considerable interest within the last year or two, and has been made possible by the introduction of the "Universal" welding machine. It is intended to locate these plants in centres where there are numerous manufactories having considerable work to be done, and yet not enough individually to make it desirable for them each to put in a welding plant.

The Mica Insulator Company, 218 Water Street, New York, offers the following quotation from the London "Electrical Engineer," as an evidence of the quality of its "Micanite" insulation. In describing the gigantic Ferranti alternator, recently installed at Deptford, the article goes on to say, in reference to the armature (which weighs 35 tons): "The smaller end is of solid brass, burnt onto the strips; and to this is connected the inner end of the bare copper conductor. The segment is then wound with the conductor, which has corrugation to prevent side displacement, and the adjacent turns are insulated. Two adjacent segments are clamped together in one carrier, and the outside ends of these conductors are connected where they touch; the two bolts clamping them into the carrier, then form the two connections to the segments. The insulation between the carrier and the coils is affected with Micanite shields. The carriers consist of two heavy brass castings clamped onto the segments. The complete carrier is supported on two bolts projecting from the rim. The insulation of these bolts is a matter of great importance. The field coils on this Ferranti alternator are constructed by winding bare copper strips on edge into a spiral, with insulation between adjacent turns. The whole of these coils are connected in series, and we are informed that at full load the machine will require about one per cent. of the full power for excitation. The section of the segment is not increased at the pole faces. The danger of the high voltage from the bare copper of the armature sparking across to the field has been overcome, in this case, by placing Micanite caps over the poles. These caps, which are about ⅛ inch thick, have all been tested up to 25,000 volts. Since being in use no faults have developed in them." The Mica Insulator Company, it may be added, has recently established a factory in London, England, where Micanite in its various forms is manufactured.

The Lodge & Davis Machine Tool Company, of Cincinnati, O., has passed into the control of Mr. Thos. P. Egan, president of the J. A. Fay & Egan Company; Mr. Chas. Davis, president of the Lodge & Davis Machine Tool Company; Mr. Robert Laidlaw, president of the Laidlaw-Dunn-Gordon Company, and Mr. Thos. McDougall, a well-known Cincinnati attorney, through the purchase of $240,000 worth of stock in that company, heretofore held by William Lodge, Samuel Lodge and Mary Lodge. This terminates a long and bitterly contested legal controversy, and puts on its feet one of the strongest manufacturing industries in the country. Few concerns have come into prominence more rapidly than the Lodge & Davis Machine Tool Company. It was incorporated in 1886, with Mr. Chas. Davis as president, and under his well-defined and aggressive management the business grew rapidly. New buildings were added from time to time to handle its increasing trade, and to-day comprise a floor space of over 60,000 square feet, and furnish employment to nearly 600 men. The machines produced in this enormous plant are used in the manufacture of locomotives, stationary engines, steam pumps, dynamos, motors, agricultural implements, sewing machines, bicycles, woodworking machines, mining machinery, etc. It is known as a very prosperous enterprise, has no indebtedness or preferred stock, and on Jan. 1 will declare a dividend of 6 per cent. for the last six months. The new officers of the company will be Mr. Charles Davis, president; Mr. H. W. Burtner, vice-president and treasurer, and B. B. Quillen, secretary. The Lodge & Davis Machine Tool Company, the J. A. Fay & Egan Company and the Laidlaw-Dunn-Gordon Company, operate their own stores in the principal cities of the country, and under the present arrangement it is probable that these will be consolidated to curtail expenses.

The Michigan Electric Company, of Detroit, Mich., reports a most satisfactory growth of their business during the past year. Since August, when it was appointed Michigan agent for the General Electric Company, it has been most successful in securing orders for machinery, etc., of the General Company's manufacture. Some recent contracts aggregate over 900 kilowatts of machinery, including D. C., arc and A. C. generators. In sales of Edison incandescent lamps and general electric lighting supplies it has secured a very large amount of business. The new-type Edison lamp has proven a particular favorite with the trade. In the railway line it has secured an order for four double G. E.-1200 motor equipments for the equipment of the Oakland County Railway, to run from Detroit to Pontiac, and has the promise of a number of other orders for similar equipments. The General Incandescent Arc Light Company's constant potential arc lamps, which it handles, have been pushed with such success that they are now used almost exclusively in Detroit and vicinity. A few recent installations, aggregating over 100 lamps, with "Simplex" wire, has also had great success, having secured its exclusive adoption in many of the most prominent buildings in its section, including the new Mabley building (14 stories), which will be the largest and most prominent building in Michigan. Other specialties for which it is agent, such as Cutter flush switches, Automatic Switch Company's motor-starters, etc., have been pushed to such good effect that they are now universally used in all first-class installations in its section. The "Michigan" overhead railway material, which this firm manufactures, it reports as having had a very satisfactory sale, railway companies who have once tried this material, as a rule, sending in many duplicate orders. Owing to the rapid increase in the business of this company, it has had to increase its quarters several times during the year.

The Westinghouse Machine Company, Pittsburg, will shortly enter upon the 15th year of its existence, in new shops, having nearly four times the capacity of its present overcrowded quarters. The policy of this company has always been progressive; it was a pioneer in the high-speed engine business; it was the first in this country to produce a high-speed compound engine; it was the first to build and advocate the non-condensing compound engine and to demonstrate to an incredulous public that compounding without condensing is not only practicable but profitable. It has now secured the sole rights in this country and Canada for the Parsons steam turbine. The Parsons turbine is designed primarily for driving electric generators and has demonstrated beyond question its ability to develop a horse-power with a smaller expenditure of steam, than the highest type of multiple expansion reciprocating engine made. During the past year over 50 Westinghouse engines have been sold in foreign countries. While this fact in itself may not be remarkable, it is a notable and a flattering testimonial to the merits of the Westinghouse engines, that fully one-half of the number exported have gone to France and Germany, where labor and materials are cheap, where freights and import duties are high, and where workmanship has reached the highest degree of refinement. In its methods of manufacture the Westinghouse Machine Company has much to offer which cannot fail to command the interest and appreciation of the practical engineer. The thorough and systematic testing of all its product, the inspection department maintained by the selling agencies, independent of the company itself, the daily physical tests of foundry mixtures, and other features peculiar to this company alone. Visits from practical men are welcome at all times, the company believing that its best interests are served by personal contact with those capable of recognizing and appreciating advanced mechanical practice.

The Diamond Machine Company, of Providence, R. I., was founded in 1883 by the late Benj. H. Hadley. At that time the title of the firm was the Diamond Emery Wheel & Machine Company, and this continued to be the firm name until the present concern was incorporated June 1, 1894. After a fire, which consumed the larger part of the books, drawings, photographs, machinery, etc., of the company, a plot of ground about five acres in area was purchased on Atwell's Avenue, near Valley Street, and bordered by the Woonasquatucket River. On this lot a three-story brick building, 205 feet long and 60 feet wide, and several other smaller buildings were erected, which are equipped with the latest and most improved machinery of all descriptions, for the rapid and economical manufacture of the machines made by the company, an electric light plant, elevators, traveling cranes, etc. The shop is one of the best lighted in the city, and is in many respects a model establishment. It is the largest manufactory exclusively devoted to the making of

grinding and polishing machinery in this country, if not in the world At first only a few sizes of plain grinding machines were made and the catalogue of 1886 shows seven styles only; it is a modest pamphlet of about 20 pages. The present catalogue of grinding machinery alone contains 64 pages, illustrating more than 40 different machines for grinding of various descriptions. These machines include plain grinders, water tool grinders, punch and die grinders, universal grinders and many others. From time to time a line of polishing and buffing machinery was added to the other productions of the firm, as well as a large variety of speed lathes, which as well as grinding and polishing machinery contain many valuable patented features, and the complete catalogue contains 180 pages, showing more than 100 different patterns of machines. The firm has agencies in various parts of the country, and is represented by strong firms in London and Germany. The productions of the concern have gradually found a way on account of their merit to foreign countries, and the trade with South Africa and South America is increasing.

THE CENTRAL ELECTRIC COMPANY, of Chicago, with branches in St. Louis, Kansas City, Buffalo and New Orleans, is one of the most extensive electrical supply houses in the world, and includes among its more important specialties the following lines: Okonite wires and cables, Okonite and Manson tapes, Interior conduit, Lundell motors, Helios incandescent arc lamps, Pharos incandescent lamps. Mr. Geo. A. McKinlock, president, gives the business his careful and undivided attention, and is assisted by a staff of experienced men. D. E. Goe, manager, is an expert in the handling of the pen and artist's brush, and his happy combinations in the form of advertisements contribute largely toward making his house widely and favorably known.

THE FORT WAYNE ELECTRIC CORPORATION, Ind., for the past year and a half, or ever since this corporation broke away from the control of the General Electric Company, has made most remarkable progress, far overreaching the expectations of Mr. R. T. McDonald, president and general manager, who foresaw the advantages of such a move and carried it out to a successful issue. The excellent business management, as well as the superior class of electrical machinery which this corporation manufactures, has so seriously taxed the capacity of the works that they have been running thirteen hours a day for the past five months, and are still several months behind on orders. This speaks volumes for the success of the "Wood" systems of electrical machinery and the satisfaction it is giving to purchasers, to whom, in order to keep fully informed of the additions and improvements made to the "Wood" systems, the corporation has just issued a new catalogue containing 132 pages, profusely illustrated and popularly descriptive of this machinery. This catalogue is beyond question a valuable addition to electrical literature, as well as a work of art, and worthy of a place in any library. After the 1st of January the corporation contemplate running night and day with two gangs of workmen, or until such time as the new addition to the works can be completed. This addition is to be a large building, steel and brick structure, 90 feet wide and 400 feet long, the first floor to be 16 feet high, with balconies 12 feet high. Between the balconies there is to be a traveling crane of 30 tons capacity, suitable for handling heavy machinery, including direct-connected dynamos of from 25 to 1500 kilowatts capacity, the patterns for several sizes of which are already completed. The estimated cost of the building, machinery and steam plant is upward of $200,000. When this structure is completed, the corporation feels certain that there will be no further delay in filling orders, and that it will be able to manufacture dynamos or electrical machinery for any purpose to which they can be applied. Among the very latest pieces of apparatus brought out by this corporation is a new alternating-current motor designed for use on ordinary single-phase lighting circuits.

THE MISSOURI TELEPHONE MANUFACTURING COMPANY, of St. Louis, Mo., has just removed to its elegant new quarters, 917 and 919 Market Street, where, with better facilities, it is prepared to promptly turn out the increasing orders which have been flowing in for telephones and telephone switchboards, etc. Its trade has increased so much in the last year that this move was compulsory, and the new shop, complete in every respect, is claimed to be the largest manufacturing establishment in the West exclusively devoted to telephones. Mr. Kusel, the secretary and treasurer of this company, which has been in existence two years, is one of the best posted young men in the telephone business of to-day, having made a careful study of the progress of all matters relating to this field, and has built the company up to its present standing by his zealous business qualifications. The company has in its employ a superintendent, Mr. Edward L. French, who has charge of the factory and the installation of all telephone exchanges built by it. Mr. French is an electrician of recognized ability, and is well known to a majority of electrical workers all over the country. To him a large portion of the success and the inventions of this company are due. This company also manufactures a switchboard for central-station work, for which a number of distinct features is claimed, the principal one of which is the plugging in arrangement. By simply inserting the plug in any plug-hole, it cuts off the ground of the corresponding subscriber and throws on the generator; the entire working part of the switchboard in connecting subscribers can be operated with one hand. Every subscriber has a plug-cord and plug-hole, each plug-cord being partitioned off in a separate slot, thus allowing no chance for the cords to get twisted with one another, and thereby necessitating the operator to stop to untangle them. After a subscriber is through talking and asks to be disconnected, by simply pulling out the plug the cord flies back without interfering with anything else. None of the working parts of the switchboard is exposed to dust and dirt or accessible for tampering; only the front of the indicating drops with the numbers stamped on them and the plug-holes are exposed to view. They have a clever device for a night bell, which is very simple and positive in its action.

THE GORDON-BURNHAM BATTERY COMPANY, of 82 West Broadway, New York, believes that there are few concerns in this country whose books would show the following substantial business during the last year, the first year of its existence: The Gordon primary battery during this time has been introduced on over 30 railways, and in every case the reports as to its performance in active service has been of the highest character. Many of the leading cities and towns are using the Gordon cells in the fire alarm service and they have been endorsed by the principal fire alarm experts in the country as being vastly superior to the gravity battery for this service. The leading telephone companies throughout the country are using these cells, and in no instance has there been reported any failure on the part of the battery to do all that is claimed for it by the company. In the United States to-day there are at least 50,000 primary batteries used by the various gas engine companies. Every large concern is now using the Gordon cell and the reports received are of a very high character. The record they have made is considered phenomenal in this service—that is, in the generation of an electric spark for the operation of gas engines. Many of the large cotton mills of the country are equipped with these cells for the operation of automatic fire alarm apparatus and of time and watchmen's clocks. The company guarantees that under any working conditions the output of useful energy from the Gordon cell is four times greater than that of the well-known gravity cell. It has none of the disadvantages of the gravity cell, and one of its especial advantages for railway signal work is that it cannot be frozen on exposure to the weather and requires absolutely no attention during its entire life; on the other hand, the gravity cell under working conditions requires protection from the cold either by sinking in a battery well below the frost line or by heating by stoves in battery houses and also requires attention for more or less recharging every 10 or 15 days, whereas, the Gordon cell under the same conditions would last fully six months without any attention. The company has found it necessary to greatly increase its facilities for the production of these cells and orders are being received from all parts of the country in large numbers, and the prospects for the coming year seem to be of the most substantial character.

THE PITTSBURG REDUCTION COMPANY, Pittsburg, Pa., is the sole manufacturer in this country of aluminum, which is made at its works at New Kensington, Pa., using steam power for generating the electric current needed in the electrolytic manufacture of the metal by the Hall process, and also at its works at Niagara Falls, N. Y., using water-power furnished by the Niagara Falls Power Company, and the Niagara Falls Hydraulic Power & Manufacturing Company. Aluminum is now being sold in alloys at rates which put it directly in competition with brass and copper. The Pittsburg Reduction Company's special casting alloy, containing over 75 per cent. pure aluminum, having a tensile strength equal to brass, has a specific gravity of only 3.0 against brass at 8.25. For the handles upon electric cars and other hardware castings, the metal is now being used, as it has the advantage of being only about one third as heavy as brass and no more expensive than brass. This alloy retains its polish much longer than brass, and with one half the care given in keeping brass polished, it is kept in a bright and well-polished condition. The Pittsburg Reduction Company is also selling large amounts of aluminum in the form of what is called "Nickel-Aluminum," which is rolled into sheets and bars, having the hardness of hard-drawn brass. This metal has a tensile strength of about 40,000 pounds per square inch, and is being used in many parts of machinery where lightness is a desirable quality, as it is wherever there is reciprocal motion to be overcome, the less momentum of the aluminum adding considerably to the efficiency of the apparatus. Pure aluminum is now being used in many places as electrical conductors in the place of copper, on account of its lightness, requiring less supports than copper rods. The Pittsburg Reduction Company has within the past few months erected the largest train of rolls yet built for rolling aluminum in the world. This train of rolls has 84 inches face of rolls and 24 inches diameter of train. With this mill it is able to roll plates of aluminum up to six feet wide and one half inch thick, and in sizes as large as steel boiler plate are ordinarily gotten out. The demand for aluminum is a growing one in many lines of the industrial arts, and the Pittsburg Reduction Company is rapidly enlarging its plant to meet the growing demands for the business, both at its works at New Kensington, Pa., and at Niagara Falls, N. Y. The company has a New York store at 10 and 11 Havemeyer Building; a Philadelphia store at 360 Bullitt Building, and a Chicago store at 132 Lake Street, with main offices at 701 Ferguson Block, Pittsburg, Pa.

NEWS OF THE WEEK

Financial Intelligence.

THE ELECTRICAL STOCK MARKET.

NEW YORK, Dec. 28, 1895.

LAST WEEK'S sharp decline was followed on Monday by a generally better feeling throughout the stock list. Both electric and traction securities shared in the improvement. The holiday break, however, produced the usual dullness, which was followed yesterday and to-day by lower prices.

THE TRACTIONS.—The most active, if not the strongest, stock among the tractions has been that of the Buffalo Railway Company. A comparatively large amount sold during the week around 70. The bonds, however, both "Consols" and "Crosstowns," are dull and inclined to be weak.

BROOKLYN STOCKS recovered during the week much of their previous losses, Brooklyn City Railway being especially strong. Sales of the stock are reported as high as 171, while Brooklyn Traction common is in fair demand around 9¼. The efforts of the various roads to obtain the right to run their cars over the Brooklyn Bridge have attracted some attention, and the successful company should largely increase its business. The Brooklyn City Railway offers to build an elevated structure over the roadways on which to operate its cars, while the Nassau Electric (which is negotiating with the Atlantic Avenue line looking toward consolidation), desires to run its cars on the roadway proper. Both companies agree to make the necessary alteration at their own expense and pay in addition for the privilege of crossing the Bridge.

ELECTRICAL STOCKS.

	Par.	Bid.	Asked
Chicago Edison Company	100	130	125
Edison Electric Ill., New York	100	95¾	97½
" " " Brooklyn	100	110	115
" " " Boston	100	145	150
" " " Philadelphia	100	..	115
Edison Ore Milling	100	13	15
Electric Storage Co., Philadelphia	100	24½	25
Electric Storage, pref	100	25	..
General Electric	100	25¼	25½
General Electric, pref	100	60	63
Westinghouse Consolidated, com	50	..	30
" " pref	50	54	54½

BONDS.

Edison Electric Ill., New York	105	105½	105½
Edison Electric Light of Europe	100	75	85
General Electric Co., deb. 5s	100	..	90¼

TELEGRAPH AND TELEPHONE.

American Bell Telephone	100	..	200
American District Telegraph	100	..	40
American Telegraph & Cable	100	90	95
Central & South American Telegraph	100	117	120
Commercial Cables	100	150	..
Erie Telephone	100	61	62¼
Gold & Stock Telegraph	100	105	..
New England Telephone	100	35	86
Postal Telegraph-Cable	100	82	83
Western Union Telegraph	100	85⅛	35½

ELECTRIC TRACTION STOCKS.

Baltimore Traction	25	16⅝	16⅞
Binghamton RR. com.	100	100	..
Brooklyn Traction	100	9	11
" " pref.	100	55	58
Buffalo St. Ry.	100	69	71
Cleveland City Ry.	100	69	70
Cleveland Electric Ry.	100	59	60¾
Columbus St. Ry.	100	45	50
Hestonville	100	50	..
Long Island Traction, all pd.	100	16½	17½
New Orleans Traction	100	17	19
" " pref.	100	67	68
North Shore Traction	100	25	30
" " pref.	100	..	80
†Philadelphia Traction	50	64	64⅓
Rochester St. Ry.	..	..	37
Steinway, Ry.	..	50	..
Union Ry. (Huckleberry)	100	112	115
Union Traction, rcts $5 pd.	..	10⅝	11
West End, Boston	100	66	66¼
" " pref.	100	93	..
Worcester Traction	100	15	17
" " pref.	100	83	86

BONDS.

Buffalo St. Ry. 1st con. 5s	100	104	105
*Binghamton Railway Co. 5s	100	99	100
Cleveland Elec. Ry. 1st mtge 5s	100	100	103
*Columbus St. Ry. 1st 5s	100	..	100
Rochester St. Ry. 1st 5s	100	102½	104
*Union Ry. 1st mtge 6s	100	105	108
*Westchester Electric 1st mtge 5s	100	98	101

* With accrued interest.
† Ex-Rights.

NEW ORLEANS TRACTION.—The publication of the earnings of the New Orleans Traction Company early in the week had a strengthening influence on the stock. In common with the general market, however, the stock declined, and closed dull and heavy. The report of the company for the year ending Nov. 30 shows gross earnings of $1,327,756, an increase of $376,228, while the net earnings have gained $244,578 during the same period. For the month of November alone the net earnings increased $23,767. These earnings are said to be sufficient to pay all fixed charges, the dividend on the preferred stock and leave a surplus applicable to the common. The road last year was operated only partially by electricity.

WORCESTER TRACTION, preferred, on fair local demand, holds its own in spite of the general dullness. Few sales of the stock are reported of late. The annual meeting of stockholders will be held on Jan. 16.

Special Correspondence.

NEW ENGLAND NOTES.

Branch Office of THE ELECTRICAL WORLD,
Room 91, Hathaway Building, 620 Atlantic Ave.,
BOSTON, MASS., Dec. 28, 1895.

THE SEWING MACHINE CABINET COMPANY, Bridgeport, Conn., has for years been actively inentified with telephone and electrical cabinet work, and its products have always given perfect satisfaction, a fact which, in connection with the broadening of the telephone field, interested parties will do well to keep in mind. While, however, it makes a specialty of this work, it carries no stock and manufactures only on orders. What it does is well done, and this is always the best testimony.

A. W. CHESTERTON & CO., 49 India Street, Boston, Mass., is one of the oldest firms in manufacturing and jobbing in engineers' supplies, and its recently introduced specialty, the "Genuine" Ingalls tube scraper, with wire brush attached, is proving a great "winner," as it is one of the best and most reliable scrapers in the market. The spring being thoroughly protected from the heat of the tube by a shield, renders it very durable, and being placed in the position it is, at the end of the scraper, acts equally on each arm, so that uniformity of pressure is obtained. A scraper made in this style scrapes equally as well when being withdrawn as when being pushed through the tube. On this account it is a labor-saver, and with wire brush attached it makes as nearly a perfect tube cleaner as can be desired.

WESTERN NOTES.

Branch Office of THE ELECTRICAL WORLD,
936 Monadnock Building,
CHICAGO, Ill., Dec. 27, 1895.

THE INDIANA RUBBER & INSULATED WIRE COMPANY, Jonesboro, Ind., has removed its general office from Marion, Ind., to the new office building at its factory in the former place.

THE C. E. WOOD COMPANY, 1316 Monadnock Building, made an assignment, on Dec. 23, to C. E. Wood. The company manufactured electrical supplies, and the assets are $1000, with liabilities of the same amount.

THE WESTERN OFFICE of the Safety Insulated Wire & Cable Company, Chicago, has just finished a contract with the West Chicago Street Railway Company for 60 miles of underground feeders, and over 1000 joints. The above company has now a large contract on hand for underground feeders for the Pabst Power Company, Milwaukee.

THE KENOSHA ELECTRIC LIGHT COMPANY'S plant at Kenosha, Wis., has been purchased by the recently organized Kenoska Light & Power Company. The officers of the new company are W. H. Schott, president; T. L. Paulson, vice-president, and Charles J. Wakeman, secretary and treasurer. The new company will make all necessary improvements.

MR. SAMUEL BARNES, late electrical engineer of J. B. Stone & Co., London, England, has returned to America, and will enter upon active work at Grand Rapids, Mich. Mr. Barnes has built and operated some of the largest electric railways in the United States, and succeeded in introducing someAmerican ideas when abroad, where he made visits of inspection to most of the European street railway plants.

THE BYRANT ELECTRIC COMPANY'S Western office has been very busy this fall. The new catalogue issued the latter part of the Summer, in which all the new specialties were incorporated, seemed to be appreciated by the trade. Thomas G. Grier and Edward R. Grier, the Western managers for the Bryant Electric Company, extend a cordial invitation to their friends and customers to make 1436 Monadnock Building their headquarters when visiting Chicago.

ELECTRIC LIGHT, TELEPHONE AND STREET RAILWAY COMPANIES find that one of the most important purchases they make is cedar poles. Prominent among the dealers in this material is Edward E. Ayer, who has his main office in the Old Colony Building, Chicago, and yards at Menominee, Alpena, West Bay City, Mich., and Chicago, Ill. Years of experience in furnishing many companies their requirements in this line, and an extensive producing territory in Wisconsin, Michigan and Canada, places Mr. Ayer in a position to fill all orders intrusted to him in a most satisfactory manner, and at low prices.

DETROIT ELECTRICAL WORKS.—L. Warfield and W. A. Jackson, trustees of the Detroit Electrical Works, in a circular dated Dec. 23, announce to certificate holders that the time expired on Dec. 1 for the reception of subscriptions under the plan of reorganization proposed by the committee, which plan was referred to and recommended in the circular issued by the trustees dated Sept. 23, 1895, and sent to all certificate holders. The trustees are informed by the committee that but twelve subscriptions have been received in all, and that on account of the non-assent of a sufficient number to make it feasible to carry it out, the plan has been abandoned. The trustees therefore serve notice that there is no plan pending for reorganization, and that they propose to ask the court for direction as to their duty in the care and disposition of the trust property.

ELECTRICAL MATTERS IN DETROIT are in a flourishing condition. The older firms have been receiving liberal patronage, and at least one new firm has come into existence within a few months, and is receiving a large share of the patronage. This firm takes the patriotic title of American Electric Company, and is managed by W. J. Hardwick, who, though comparatively young in the business, is making a successful attempt to establish his firm. The latest successful electrical display in Detroit was that at the Masonic Fair. The lighting was done by a temporary plant, installed by the Detroit Motor Company, which has the contract for the permanent plant. The general arrangement of the lighting was made by a committee, of which W. T. Benallack, the electrical inspector for the Michigan Inspection Bureau, was chairman. The work was done by the American Electric Company The whole of the work was put in in an almost incredibly short time, considering the fact that it was the most gorgeous ever seen in these parts. Many of the devices were never before exhibited in this part of the country, and some of them were shown in public for the first time. The electrical companies in Detroit gave generous assistance in making the display. About 2500 incandescent lamps were used, and a number of arc lamps were placed for general illumination. On the front of the building were shown many of the Masonic emblems. There was the square and compass, the cross of the Commander, the triangle of the Consistory, and many other designs. Every floor and department had something unique in electrical novelties.

ENGLISH NOTES.

(From Our Own Correspondent.)

LONDON, Dec. 18, 1895.

ARGON.—The "Academie des Sciences" has awarded the Le Comte prize of £2000 to Prof. Ramsay and Lord Rayleigh for their discovery of argon.

THE RATING OF TELEPHONE WIRES.—An important case was heard yesterday at a South London county court. It was an appeal by the National Telephone Company against the rating proposals of certain parishes. The local authorities in question have hitherto assessed the telephone company on the basis of the mileage of wire within their district. At the quinquennial valuation in 1890 the assessment committees had put the assessment at 30s. per mile, but in view of the increase of telephone business it was, in the present year, raised to 49s. per mile, and the counsel for the local authorities expressed an opinion that it ought to be a great deal more. The case occupied the whole of the day, and the Court dismissed the appeal of the telephone company, which, as the interests involved are of great magnitude, proposes to carry the matter to a higher tribunal.

THE INSTITUTION OF ELECTRICAL ENGINEERS.—At the annual meeting of the Institution of Electrical Engineers, on Thursday last, the reading of the annual report gave rise to a desultory debate. Mr. J. Raworth, of the Brush Company, got up and moved a portentous resolution, calling upon the meeting to appoint a committee to advise the Council upon the welfare of the Institution. Mr. Raworth's intention to make this proposal was known only to a few selected friends, and although there was an evident desire on the part of the meeting to induce the Council to alter its mode of election there was an equally evident disinclination to support such a revolutionary proposal which had been so suddenly sprung upon the meeting. Voting that evening upon Mr. Raworth's proposal was finally ruled out of order, and a special general meeting of the Institution is now to be called to vote and discuss upon it.

THE 200-VOLT LAMP QUESTION —It is very evident, and indeed quite right, that enthusiastic central-station engineers are not going to have it all their own way in the matter of changing the standard supply pressure from 100 to 200 volts. *The Builder*, a singularly well-informed non-electrical paper, has some cogent remarks upon the ugliness and short life of 200-volt lamps, and on the alarming nature of 200-volt arcs caused by melting of fuses. In Tuesday's *Times* there was a long letter from Major Flood Page, of the Edison-Swan Company, who says that he views with some alarm the efforts of electrical engineers to increase the pressure of the current delivered to the consumer. It is, he says, supposed by some that a difficulty has arisen in the manufacture of glow-lamps to meet this demand. The lamp difficulty, however, is the smallest one in connection with the matter. A far more serious question, in Major Flood Page's opinion, and one which touches very closely upon the fire insurance question, is whether houses wired with fittings and switches manufactured for 100 volts can safely carry 200 or 220. Major Flood Page does not hesitate in giving it as his opinion that it would be far better to wait for some time yet before adopting the higher pressure. He points out that during the past three years there have been in all 2714 fires in London, only nine of which have been attributable to electricity. He would like our central-station managers to pause before altering this state of things. Major Flood Page concludes his letter with an intimation that in his opinion engineers are prohibited under the Electric Lighting Act of 1882 from making the proposed alteration. The words of the act run as follows: "The undertakers shall not be entitled to prescribe any special form of lamp or burner to be used by any company or person, or in any way deal or interfere with the manner in which electricity supplied by them under this act, or under any license or special act shall be used." The primary sense of these words, the Major admits, is probably that the electric light undertaker shall not recommend the lamp of any particular maker, but he thinks it may also bear the interpretation that the undertakers may not arbitrarily compel the customer to change his lamps. The progessive party have succeeded, no doubt much to their own astonishment, in inducing the Board of Trade both to permit the higher pressure and to allow the neutral of a three-wire system to be earthed, but it is evident that many of the older members of the profession view the proposed alterations with alarm, and that the consumer will be incited into making a vigorous protest.

MUNICIPAL ELECTRIC LIGHTING IN EDINBURGH.—Prof. A. B W. Kennedy, electrical adviser to the Edinburgh Town Council, has recently had occasion to make an exceedingly pleasant report with regard to the progress of the electric lighting station in that city. He advised the Town Council to lay down a plant to supply 40,000 eight-cp lamps connected, and led them to expect that this figure would be reached within two or three years, and that the works' costs (including all office expenses) would, when the output reached 300,000 units per annum, be about 3d. per unit sold. Prof. Kennedy now finds that after only seven and a half months' working the lamp connection has reached an equivalent of 45,600 eight-cp lamps, and that the works' costs (although the output in the 34 weeks has only been 285,000, and the greater part of this 34 weeks has been Summer-time,) averaged 1.56d. per unit sold. With this data to go on, he now prophesies that by April next, which will be the end of the first year of operation of this station, 800,000 units will have been sold, and that the average for works' costs will be about 1½d. The total income earned will then be £16,000, and the Town Council will possess a balance of between £2000 and £3000 after paying everything, including interest and sinking fund. It is needless to say that one outcome of this favorable result will be the immediate extension of the plant. Prof. Kennedy also suggests that the voltage between the outer and middle wire of the three-wire system should be raised at an early date to 200 or 250 volts. With regard to the consumers' lamps, he suggests that the Town Council should issue a notice to the effect that on and after May, 1896, the standard voltage will be 220 in respect to consumers connected after that date, and that on and after August 1897, the new voltage will be standard for the whole system, and finally that as any time between these dates, the Town Council will be ready to supply any existing customer with new 220-volt lamps at 6d each, the old lamps becoming the property of the Council. The effect of this last clause, Prof. Kennedy thinks, will be that each customer will run his existing set of lamps as long as possible, and then buy a new set cheaply from the Town Council. He estimates that the loss will be about 8d per lamp, and as the present lamp connection is equivalent to about 40,000 8-cp lamps, and means probably about 20,000 actual lamps, the cost of the total operation will be under £700, and the carrying capacity means (for the same percentage drop) will have been quadrupled; an operation which would have cost about £60,000 had it not been necessary to quadruple the capacity by laying extra copper.

General News.

NEW INCORPORATIONS.

THE OREGON ELECTRIC LIGHT & POWER COMPANY, Oregon, Ill., has been formed by Albert H. Knodle, William L. Taylor and H. Lee Allen, for the purpose of furnishing electric light, heat and power. Capital stock, $50,000.

THE RIDLEY PARK ELECTRIC LIGHT, HEAT & POWER COMPANY, Ridley Park, Pa., has been organized by Richard S. Pomeroy, Charles C. Darrach and Harry H. Sawyer, Ridley Park, Pa., for the purpose of supplying electric light, heat and power. Capital stock, $1000.

THE AMARILLO REALTY & LIVE STOCK COMPANY, Kansas City, Mo., has been formed by H. B. Sanborn, Wm. H. Craddock and C. P. Haney, Kansas City, Mo., for the purpose of doing a general real estate business, supplying gas, water and electricity. Capital stock, $25,000.

THE CONNECTICUT ENGINEERING COMPANY, Norwich, Conn., capital stock, $5000, has been organized to establish, construct and operate electric light and power plants. The promoters are George W. Phillips, A. E. Rich, George W. Hunt, George E. Raymond, Norwich, Conn.

THE BOSTON ELECTRIC INSULATED POLE COMPANY, Portland, Me., has been incorporated by Edward E. Drew, Boston, Mass.; Edwin L. Dyer and George E. Macgowan, of Portland, Me., for the purpose of manufacturing, dealing in and erecting insulated poles. Capital stock, $100,000.

THE LORD ELECTRIC COMPANY, Boston, Mass., capital stock, $15,000, has been formed for the purpose of manufacturing, purchasing and selling electrical appliances and doing all kinds of electrical construction work. The promoters are Fred. W. Lord, Thomas P. Curtis and Nils Olson.

THE J. E PUTNAM COMPANY, Rochester, N. Y., has been incorporated for the construction and sale of electrical appliances, apparatus, fixtures, specialties and machinery. The promoters are Sylvanus E. Ellis, Joseph E. Putnam and William B. Hale, Rochester, N. Y. Capital stock, $15,000.

MARTHA'S VINEYARD ELECTRIC LIGHT & POWER COMPANY, Cottage City, Mass., has been incorporated by John A. Duggan, Josiah Quincy and John B. Graham, for the purpose of manufacturing, generating and selling electricity for light, heat and power. Capital stock, $15,000.

THE LA CAPITAL COMPANY, Portland, Me., capital stock, $1,500,000, has been formed for the purpose of manufacturing and dealing in electricity for purpose of light, heat and power. Those interested are Theo. N. Vail, Lyndon, Vt.; Francis A. Houston, Boston, Mass., and Edward K. Milliken, Deering, Me.

THE LOGAN COUNTY ELECTRIC LIGHT COMPANY, Lincoln, Ill., capital stock, $10,000, has been formed to furnish electric light and power and to heat buildings by steam. Those interested are John A. Lutz, R. H. Gaines, John St. Gerny, Charles C. Reed, T. A. Reynolds, Adam Denger and D. H. Harts.

THE UNITED ELECTRIC LIGHT COMPANY, Kansas City, Kas., capital stock, $100,000, has been incorporated for the purpose of operating electric plants for supplying light, heat and power. Those interested are C. F. Hutchings, Benjamin Friedburg, Benjamin Schnierle and Marcus Harris, Kansas City, Kan.

THE EXCELSIOR ELECTRIC COMPANY, Port Huron, Mich., capital stock, $120,000, has been incorporated by Henry McMarrao, W. F. Davidson, C. F. Harrington, Charles D. Thompson and F. C. McNutt, Port Huron, Mich., for the purpose of manufacturing and operating arc and incandescent appliances.

THE PITTSBURG, BRADDOCK & McKEESPORT STREET RAILWAY COMPANY, Pittsburg, Pa., has been formed to build an electric street railway in the city of Pittsburg. The promoters are Charles H. Johnston, and William Robinson, Pittsburg, and Walter Farmariss, Philadelphia, Pa. Capital stock, $66,000.

THE WALKER COMPANY, Jersey City, N. J., has been incorporated to manufacture and sell electric generators and motors and all kinds of electrical apparatus, also products of iron and steel. Those interested are John L. Ludwig, Brooklyn, N. Y.; Charles N. King and Martin W. Dixon, Jersey City, N. J. Capital stock, $2,500,000.

THE SEHANCE & FAIR ELECTRIC COMPANY, Chrisman, Ill., capital stock, $6000, has been formed for the purpose of constructing, buying, selling and operating telephone and telegraph lines, plants and supplies, and for doing a general electric business. Those interested are George W. Fair, John C. Sehance, Byron Ash and James Hoult.

THE PACIFIC CABLE COMPANY, Jersey City, N. J., capital stock, $1,000,000, has been incorporated to construct, lay, operate and maintain electric submarine cables in the Pacific Ocean, with telegraph lines and connections for the transmission of messages by electrical means. Those interested are Abram S. Hewitt, D. O. Mills, C. M. Dodge and Fred D. Grant, New York City.

THE HYGIENIC MILK COMPANY, Chicago, Ill., capital stock, $40,000, has been formed for the purpose of manufacturing electrical dairy and heating apparatus, dealing in the same, selling products manufactured or treated by them, and dealing in packages, containers and transmitters for the same. Those interested are Claus F. P. Korssell, William H. Fosmer and Zeno F. Keeney.

THE WESTON GENERAL ELECTRIC COMPANY, Newark, N. J., capital stock, $200,000, has been formed for the purpose of developing electrical inventions and devices, and for the manufacture and sale of electrical appliances and machinery connected therewith. Those interested are Edward Weston, Newark, N. J., Franz O. Matthiessen, New York City, and Henry E. Niese, Jersey City, N. J.

THE SPRAGUE ELECTRIC RAILWAY COMPANY, Jersey City, N. J., has been incorporated for the purpose of constructing and equipping electric and other railways, electric light and power plants, etc. The promoters are: Frank J. Sprague, Charles M. Sprague, Charles A. Benton, New York City; Edward C. Platt, Brooklyn, and Howard S. Gurmey, Jersey City, N. J. Capital stock, $1,000,000.

THE CLEVELAND & CHAGRIN FALLS ELECTRIC RAILWAY COMPANY, Cleveland, O., has been formed for the purpose of constructing and operating an electric road between Cleveland and Chagrin Falls, O., and also furnishing electric light, heat and power. Those interested are Vincent A. Taylor, F. W Gehring, Jay E. Latimer, Joseph Black, Ferdinand H. Eggers, C. C. Barkwill and Albert V. Taylor. Capital stock, $300,000.

Telegraph and Telephone.

SENECA FALLS, N. Y.—The question of a reliable fire alarm system is being discussed.

MEDINA, O.—Medina citizens are considering the establishment of a telephone system in town.

BAYSIDE, L. I., N. Y.—The residents of Bayside are agitating the question of installing a modern fire alarm system.

CENTRALIA, ILL.—The Central Union Telephone Company is making arrangements to extend the line from Nashville to Mascoutah.

NEWTON, KAN.—The City Council has granted a telephone franchise to A. R. Champlin, and telephones will be in operation here by June 1.

FLEMINGSBURG, KY.—A movement is on foot to build a telephone line from Flemingsburg to Moorfield, by way of Crains, Hilltop, Sapp, Davidson and Sprout.

DEADWOOD, S. D.—A petition has been presented to the council by George W. Cornwell, of Sturgis, for permission to construct telephone lines through the streets and alleys of the city.

SENECA, N. Y.—The telephone line at Seneca Falls will be extended through Seneca County south, touching Bearytown, Romulus, Williard, Ovid, Farmer Village and Trumansburg, thence to Ithaca.

UNION BRIDGE, MD.—The Western Maryland Telephone Company, of Carroll County, has obtained a franchise from the corporate authorities of Union Bridge for the erection of its lines in this place, and is to establish an exchange.

CHESTER, PA.—There will be a meeting of the Delaware County Telephone & Telegraph Company for the purpose of considering the franchises in the city. The company will appoint a committee to confer with councilmen and give them some idea of what they will be able to accept in the shape of an ordinance.

Electric Light and Power.

ST. JACOB, ONT.—St. Jacob is to be lighted by electricity.

HURON, S. D.—The city asks for bids to furnish 75 street lamps.

BIWABIK, MINN.—The citizens will vote Jan. 17 on the question of issuing $16,000 water and light bonds.

PARRY SOUND, ONT.—The Parry Sound Electric Light Company has been incorporated with a capital of $20,000.

CHATHAM, N. Y.—The village Board of Trustees recently held a special meeting to discuss the matter of lighting the streets.

NEWBURGH, N. Y.—The Buttermilk Falls Electric Company, of which Capt. Charles F. Roe is president, expects to instal additional equipment

SULLIVAN, ILL.—The electric lighting plant here has been destroyed by fire. Loss between $3000 and $4,000. Work on rebuilding the plant will be begun at once.

CASEVILLE, MICH.—Caseville capitalists have organized an electric lighting company, and it is the intention to put up a plant to furnish lights for both public and private use.

UNIONVILLE, MO.—Sealed bids will be received by the city authorities for making plans and specifications for combined waterworks and electric light plant, cost of said plant not to exceed $10,000.

EAST ROCKAWAY, L. I., N. Y.—Petitions are being circulated for the establishment of a lighting district, to include the boundaries of the Lynwood School district and the village of East Rockaway.

CHARLEVOIX, MICH.—Charles Gabriel, manager of the electric light company, has asked the village council for a franchise for an electric road to run between the two resorts, the depot and the park.

BRAINERD, MINN.—The election held to determine the question of selling the city electric light plant to C. N. Gibson, of Brainerd, and E. C. & P. A. Gibson, of New York, was carried by a vote of 783 to 143.

ALBANY, N. Y.—Mayor O. E. Wilson has returned to the Common Council, without his approval, the ordinance authorizing the letting of a contract for the lighting by means of electricity of the city of Albany.

PETALUMA, CAL.—The Petaluma Electric Light & Power Company has sold its plant to J. B. Burdell, a Marin County dairyman, for $20,000. The company was organized six years ago. The business is in a prosperous condition.

SHARON HILL, PA.—The Sharon Hill Borough Council has passed the electric light ordinance over the veto of the chief burgess, and the contract for the lighting has been awarded to the Citizens' Electric Light Company, of Clifton.

WESTPORT, MO.—At the Westport Council meeting an ordinance providing for the erection of an electric light plant was referred to a special committee, composed of Frank McMillan, W. P. Krepp, and City Engineer H. C. Abercromby.

PORT EWEN, N. Y.—A mass meeting of the citizens will be held in Schryver's Hall for the purpose of discussing the most feasible way of advancing the interests of Port Ewen. Among the most important of the proposed plans is the illumination of the village by electricity.

ALEXANDRIA, KY.—Judge J. K. M. Norton, of the Corporation Court, has granted a charter to the Wheeless Electric Lamp Company, the objects of which are to buy and sell patents covering electric lamps, etc. G. Hatley Norton is named as the local agent and F. B. Thompson, of New York, is president.

MONROE CITY, MO.—A company has been organized, to be known as the Monroe City Electric Light & Power Company, capitalized at $10,000, to furnish light and power for the city. The following officers have been selected: William Wood, president; W. T. Ragland, vice-president, and E. P. Melson, secretary and treasurer.

LANARK, ILL.—The Lanark electric light plant was started on Thursday night of last week, and the city illuminated for the first time by electricity, there being 17 2000-cp arc lights on the streets and 18 commercial lights. The owner of the plant, Dr. H. Reid Staley, had a hard fight to get a franchise and contract, but now the strongest opponents are well pleased and speak only words of praise. At present the arc system alone is in operation, but the incandescent system will be ready in a few weeks. Westinghouse electrical apparatus is used throughout, with a Fischer automatic engine of 80-hp.

The Electric Railway.

SYRACUSE, N. Y.—The Common Council voted against granting a franchise for a railway in East Fayette Street to the Suburban Company.

LANDING, N. J.—An electric railway is projected to run from Landing to Mt. Arlington, next Summer, and eventually along the whole of Lake Hopatcong.

PATERSON, N. J.—A scheme is on foot to run a trolley line from Paterson via Boonton, Rockaway and Dover, to connect with the proposed local line at Mt. Arlington.

DANVILLE, ILL.—It is proposed to build on electric railway, 35 miles long, from Danville to Paxton, and Joliet, Ill. Mr. J. W. Layne, of Potomac, Ill., is interested in the new line.

ELIZABETH, N. J.—The Middlesex & Union Traction Company, now operating a trolley line in Rahway, will be offered inducements to extend the tracks to Linden and Elizabeth.

YOUNGSTOWN, O.—Attorneys P. M. Durnett and Oscar Davis are working up interest in an electric railway between this city and Lowellsville. Application for a franchise will be made.

LOS ANGELES, CAL.—Work is now being vigorously pushed upon the Ninth Street branch of the Los Angeles Electric Railway, and everything will be done to bring the affair to quick completion.

ALBANY, N. Y.—The Bath & Lake Keuka Railway, recently incorporated, proposes to operate a street surface electric road, ten miles long, from the Soldiers' Home, Bath, to the village of Hammondsport.

RICHMOND, S. I., N. Y.—The Midland Railway has secured the grant of a franchise for a trolley line from the town line of Southfield to the village of Richmond, over the Richmond road, from the town board of Southfield.

BALLSTON, SPA, N. Y.—Application has been made to the highway commissioners for a franchise to build an electric railway from this place to Peck City Falls, by parties from New York, who are representing A. N Chandler & Co.

CLEVELAND, O.—The Cleveland & Chagrin Falls Electric Railway Company has been authorized to build and operate an electric railway for the

transportation of passengers, freight, mail and express between Cleveland and Chagrin Falls.

PENSACOLA, FLA.—The City Council is considering an ordinance to grant to Sterritt Tate a franchise for an electric street railway. The right of way over several miles of streets is asked and the council is disposed to act with caution in granting the franchise.

ANACONDA, MONT.—A company is being organized to build a double track electric railway between Tacoma and Seattle. The parties intend to start work within six months after securing the franchise, and finish the road within 18 months after the time of the start. The line will be called the Seattle, Tacoma & Portland Electric Railway. Hugh L. Thomas is connected with the new line.

HANOVER, MASS.—The stockholders of the New Hanover electric road held a meeting in Assinippi Hall for the purpose of considering the question of increasing the capital so as to close the negotiations with the Philadelphia Company, which is ready to carry out the plans of the corporation. The company proposes to construct the road from Queen Ann's corner, near the Hingham line, to Assinippi, and thence to the Rockland line to meet the lines of the Rockland and Abington companies.

PERSONAL.

MR. A. E. BEACH, a member of the firm of Munn & Co., and one of the edisort and publishers of the *Scientific American*, has just died.

Trade and Industrial Notes.

THE BERLIN IRON BRIDGE COMPANY, East Berlin, Conn., has just completed for the H. W. Johns Company, Brooklyn, N. Y., a new dryer house built entirely of steel.

MINING BY ELECTRICITY.—The Brazil Block Coal Company, of Brazil, Ind., a large coal operator is operating its mines by electricity, and using in this connection four engines built by the Ball Engine Company, of Erie, Pa., which aggregate 600 horse-power. This plant has been but recently put in.

LABOR-SAVING APPLIANCES.—Edwin Harrington, Son & Company, Fifteenth Street and Pennsylvania Avenue, Philadelphia, Pa., have issued a new catalogue, marking the entrance of the company into its twenty-first year of business. Many forms of hoists, tramways, traveling cranes, etc., are illustrated and described, and notice is given that a very perfect form of spur-gear hoist will soon be put on the market.

J. N. COVERT, who has been associated with William Wallace, as electrical and mechanical engineers, at Broad and East Hanover Streets, Trenton, N. J., has taken over the business of the firm, and will hereafter devote himself to electrical engineering. His long experience in practical electrical work places him in a position to know the needs of the public for his goods; he is prepared to do anything in the electrical line, and is equipped for rewinding and repairing electric machinery. He is agent for Helios arc lamps and deals in electrical supplies of all kinds.

THE UNITED ELECTRIC IMPROVEMENT COMPANY, Eighteenth Street and Allegheny Avenue, Philadelphia, the well-known manufacturer of alternating machinery, has embarked in the manufacture of incandescent lamps, in connection with its regular business. This company is making a specialty of 16 to 32 cp lamps for high-voltage and low-tension series lamps. The demand for these lamps is such that the company has been compelled to run its factory overtime in order to supply the demand. General Manager Walter F. Smith, reports that orders now booked for alternating apparatus will keep his factory busy for some months.

FLATTERING TESTIMONIALS.—In a handsome pamphlet the Lafayette Engineering & Electrical Works, of Lafayette, Ind., successors to the Muncie (Ind.) Electric Works, presents a number of letters from purchasers which express in the highest terms the satisfaction of the writers with the apparatus manufactured by this company. The Lafayette motors and dynamos are of the single-coil, salient-pole type, which enables the armature to be placed very close to the base without entailing magnetic leakage. Twelve sizes are made, ranging from one to 40 kw, and of speeds from 1900 to 850 revolutions per minute.

THE NEW BRITAIN MACHINE COMPANY, New Britain, Conn., has purchased the patents, machinery and business of the Dubuque Specialty Company, of Dubuque, Iowa, and of the J. T. Case Engine Company of New Britain, Conn. The Case automatic high-speed pedestal engines are so well-known to our readers that further reference need not be made to them. One of the standard specialties of the firm is a chain saw mortiser which, by means of a steel chain, each length of which has a sharpened tooth presented to the work a thousand times a minute, can execute mortises in an extraordinary short space of time.

THE PEN ARGYL IRON WORKS, located at Pen Argyl, Pa., build boilers, engines and hoisting machinery of every style and for all purposes. Their stationary engines, ranging from 3 to 150 hp, are self-contained, and are notable for elegance of appearance, smooth and quiet running, great power and economy of fuel. In the manufacture of hoisting and hauling machinery they have met with very gratifying success. Their hoisting engines are in use in slate and stone quarries, gold, silver, coal, iron and phosphate mines in United States Navy Yards, and by contractors throughout the country, and always give the most satisfactory service.

THE HANDSOMEST CALENDAR of the year thus far, and one that in the past has rarely been equalled in beauty of design, is issued by the Knowles Steam Pump Works, of 93 Liberty Street, New York. In the centre of an 18 x 24 inch sheet is a Pompeian floating female figure in the act of shooting an arrow, using a crescent for a bow, at a celestial appearance representing the date "1896." In the margins about the central design are grouped in an artistic manner engravings of various types of Knowles pumps. To those who are skeptical as to the possibility of thus combining artistic grace with prosaic mechanics, this calendar should prove a revelation.

AUTOMATIC CIRCUIT-BREAKERS.—In a well-illustrated catalogue, the Automatic Circuit-Breaker Company, of Newaygo, Mich., successors to the Sweet Electric & Mfg Company, of Grand Rapids, Mich., describes a number of its specialties, including the well-known "Automatic Limit Switch," which became so well-known through its predecessors in business. The long line of circuit-breakers made by this company include those for large stations, smal stations, motors, arc-light circuits, alternating-current circuits, marine and conduit work, "section" circuits, storage-battery circuit-breakers, etc. It also manufactures a manual quick-break switch in all the different forms and sizes, and a compact and efficient lightning arrestor.

THE KELLY & JONES COMPANY, Greensburg, Pa., has issued a new catalogue of flanged fittings manufactured by it according to the new standard for 200 pounds pressure, recommended by committees of the American Society of Mechanical Engineers and the Master Steam Fitters' Association. In the catalogue is embodied a copy of the dimensions thus recommended, and another special feature is the arrangement of the list for fittings with companion flanges bolted on. This list is applicable to fittings which require companion flanges on a portion only of the outlets. The information concerning dimensions of these fittings will be valuable to engineers and others who are called upon to lay out piping for steam plants. This enterprising firm is to be commended for the hearty recognition it gives to the latest engineering thought, not being deterred, as is too often the case, by the expense of making new patterns or putting in the new tools required.

DISSOLUTION OF PARTNERSHIP.—The partnership business heretofore existing between J. Grant High, G. T. Eyanson and Cyrus C. Armpriester, manufacturers of switches, switchboards and tablet-boards, 123 N. Third Street, Philadelphia, was, by mutual consent, dissolved on Dec. 17, 1895, by the withdrawal of the former partner, he having disposed of his entire interest, title and good-will to Mr. George T. Eyanson. The business will hereafter be conducted at the same address under the firm name of Eyanson & Armpriester, the former superintending the construction the same as he has been for the past two years. Mr. Eyanson is an Ann Arbor, Mich., graduate, and is the patentee of the Eyanson Quick-Break Switch, which is so favorably known in connection with the late J. Grant High & Co.'s switchboards. Mr. C. C. Armpriester, who will look after the business end, has been officially connected with railroads for the past 25 years, and is well and favorably known. We wish the new firm a prosperous business.

Business Notices.

BATTERY CUT-OUT CHEAP.—Sensitive, reliable, never requires attention. Gas lighting much improved by its use. Electric Supply Company, of 15 South Warren Street, Syracuse, N. Y.

THE ELECTRICAL COLLECTION AGENCY recently established at Birmingham, Ala., for the exclusive use of electrical manufacturers and supply dealers, will be welcomed by the trade. Much money has been lost in the South by the credit system being too liberally applied, and the object of the new agency is to protect the manufacturers and the trade generally. It is managed by a gentleman whose 14 years' connection with the Southern trade, coupled with the best of references, assures the accomplishment of its object.

Illustrated Record of Electrical Patents.

UNITED STATES PATENTS ISSUED DEC. 19, 1895.

[In charge of Wm. A. Rosenbaum, 177 Times Building, New York.]

551,757. ELECTRICALLY OPERATED ELEVATOR; Fred Brainard Corey, Boston, Mass. App. filed May 13, 1895. In an electromagnetic switch, the combination, with two actuating solenoids, of an iron core having a reciprocatory movement between the said solenoids, two conducting rods parallel to the movement of said core, an insulating bar or piece attached to said core, the said insulating piece carrying two metallic contact-pieces, each of said contact-pieces being in connection with one of the said conducting rods, and conducting clips adapted to engage said contact-pieces.

551,781. SYSTEM OF ELECTRICAL DISTRIBUTION; Thomas F. Mullaney, Worcester, Mass. App. filed Sept. 24, 1895. A system of distribution in which the conductors are divided into sections, in combination with means for throwing the grounds of the different sections upon conductors of the same polarity.

551,786. LIGHTNING ARRESTER; William R. Potter, Schenectady, N. Y. App. filed Aug. 31, 1895. A lightning arrester, comprising a number of spark-gaps in series, each spark-gap enclosed in a shute and a common magnetic blow-out for all of the gaps.

551,795. ELECTRO-GALVANIC BELT; Samuel J. Spalding, Canton, O. App. filed May 9, 1895. In an electro-galvanic belt, a series of cells connected to a sheath by means of the elastic connection and the reversible insulated and non-insulated link.

551,799. ELECTRIC ARC LAMP; Elihu Thompson and Charles E. Harthan, Swampscott, Mass. App. filed May 9, 1895. In an electric arc lamp, the combination of a globe holder mounted on a side rod, and provided with a hub and rim, openings between the hub and rim, and a cup adapted to screw on the bottom of the hub.

551,809. CONVERTING SIMPLE INTO POLYPHASE ALTERNATING-CURRENTS; Charles S. Bradley, Avon, N. Y. App. filed June 11, 1892.

The combination with a simple alternating-current circuit, of a plurality of transformers supplied thereby, means for creating a difference of phase in the several transformers, and interconnections for combining the displaced phases to produce a resultant phase or phases.

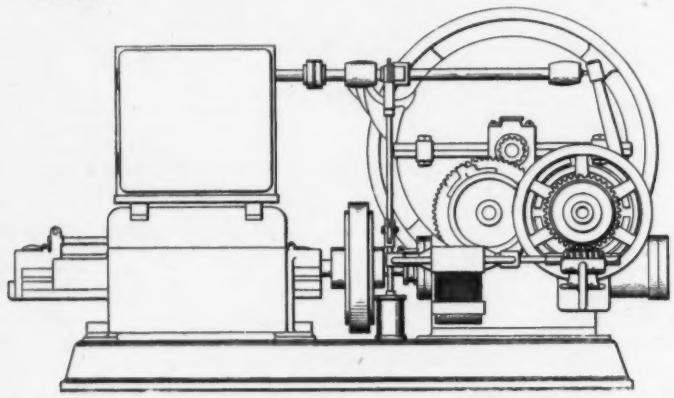
551,810. ALTERNATING-CURRENT MOTOR; Charles S. Bradley, Avon, N. Y. App. filed Sept. 12, 1893. An alternating-current induction motor comprising a primary element, and a revolving secondary element carrying a sliding switch co-operating with two or more series of contacts for varying the number of effective turns on the secondary winding.

551,820. MECHANISM FOR OPERATING ELEVATOR CONTROLLING MECHANISM; Frank E. Herdman, Winnetka, Ill. App. filed July 10, 1895. The combination with a driving motor, and controlling mechanism for the same, of an auxiliary motor, a gear on the shaft of said motor, a gear wheel meshing with the gear on said motor shaft, a friction clutch, carried by said gear wheel, and a second friction clutch wheel adapted to connect with said first-mentioned friction clutch, and connection between the last-mentioned clutch, and the driving motor controlling mechanism, and controlling mechanism for said auxiliary motor.

551,856. COMMUTATOR BRUSH; Caleb Coles Dusenbury, Lake Mahopac, N. Y. App. filed June 10, 1895. The combination with the commutator brushes of the end frame, arms of metal permanently united therewith, sleeves of insulating material surrounding said arms and upon which the brushes are mounted, and an adjustable device for applying pressure to the brushes.

551,863. ALTERNATING-CURRENT MACHINE; Maurice Hutin and Maurice Leblanc, Paris, France. App. filed May 1, 1895. A synchronous alternating-current motor having its field magnets excited by a constant current, and a condenser of suitable capacity in a shunt across the terminals of the field-magnet windings.

551,880. ELECTRIC EYE-CUP; Theodore B. Wilcox, Newark, N. J. App. filed Jan. 10, 1895. An eye-cup for application to the eye, the same carrying adjacent metals of different character adapted to constitute battery elements.



NO. 551,820.—MECHANISM FOR OPERATING ELEVATOR CONTROLLING MECHANISM.

551,930. ELECTRIC RAILWAY TRAIN SIGNALING; Walter S. Greene, Covington, Ky. App. filed Sept. 3, 1895. In an electric railway train signal, a three-wire system made up of three wires for each member of the train between which communication is desired, and couplers for connecting corresponding wires throughout the train electrically and mechanically, said couplers having duplicate sets of contacts connected up in divided circuit to the three wires.

551,942. ELECTRIC LATCH APPARATUS FOR SEMI-AUTOMATIC OPERATION ON RAILWAY SIGNALS: Harry C. Barnes and William W. Slater, Oakland, Cal. App. filed March 21, 1895. In a signal system a movable signal or semaphore, a latch lever, stop, and intermediate mechanism, an electromagnet by which the signal-controlling apparatus mechanism is actuated, a battery and wires connecting it with the electromagnet, and binding posts, with a resilient connecting arm through which the binding posts are connected when the lever and latch mechanisms are engaged, and disconnected when they are released.

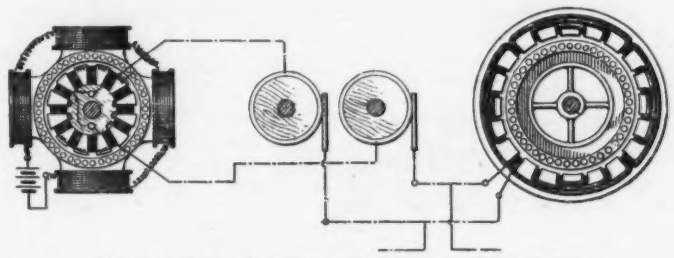
551,946. ART OF RECORDING AND REPRODUCING IMPULSES; William H. Cooley, Brockport, N. Y. App. filed April 16, 1889. A recording surface consisting in a fillet of any suitable material and means for dividing the same into two mechanically separate and distinct portions along a line, normally straight and for varying such line of division exactly according with the impulses to be recorded.

551,947. ELECTRIC TELEGRAPH; William H. Cooley, Brockport, N. Y. App. filed March 23, 1889. In a telegraphic circuit, a main-line wire, an inductorium and a relay or other receiving instrument located in such main-line circuit and at the same station, in combination with a balancing coil on such relay, a transmitting instrument located together with the primary coil of such inductorium in circuit with a source of electric energy.

551,948. ELECTRIC TELEGRAPH; William H. Cooley, Brockport, N. Y. App. filed April 18, 1893. In combination with means for sending to line alternating induced impulses, means for sending to line or not, as desired, at each such induced impulse, a battery impulse synchronizing and harmonizing therewith.

551,951. AUTOMATIC TEMPERATURE REGULATING APPARATUS; Charles L. Fortier, Milwaukee, Wis. App. filed May 8, 1893. In temperature regulating apparatus, the combination with a heat-controlling valve or damper and means for operating the same, comprising an electric circuit, including an electromagnet, thermostat and electric generator, of a motor arranged to operate said generator intermittently and automatically at frequent intervals, whereby current is produced only when needed and power is economized.

551,959. THERMOSTATIC REGULATING DEVICE; Charles A. Hale, Cleveland, O. App. filed Jan. 8, 1894. In a thermostatic regulating device, the combination of a clockwork for operating the temperature regulating devices and provided with a projecting lug upon its drive mechanism a source of electricity, a thermostat in the circuit of said source, an electric alarm in another circuit connected to said source and normally open, an electromagnet in the circuit of the thermostat and connected to be energized from the action of the latter and having an armature provided with a stop adapted to stop and release the operating clockwork, and a spring switch having its free end in the path of the lug upon the drive mechanism and normally closing the circuit of the thermostat and electromagnet, and closing the alarm circuit when engaged and moved by the lug upon the drive mechanism.



NO. 551,863.—ALTERNATING-CURRENT MACHINE.

551,982. STATION POTENTIAL INDICATOR; Ralph D. Mershon, Pittsburg, Pa. App. filed April 29, 1895. A station potential indicator for alternating-current systems, comprising a local circuit, in which the inductive and non-inductive counter E. M. F. and the impressed E. M. F. of the main line are reproduced in miniature, and a voltmeter for indicating the value of the resultant of these E. M. Fs.

551,996. PEDO-ELECTRIC TROLLEY; Robert T. Oney, Charleston, West Va. App. filed March 27, 1895. A trolley carriage comprising a motor, a switch, a frame, a switch controlling the current to the motor and means for operating the switch after the carriage has run a certain distance.

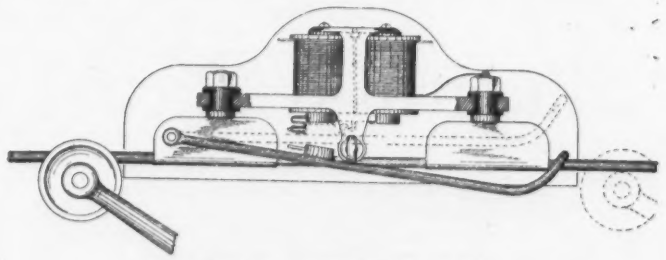
551,998. ELECTRIC SIGNAL; Eugene M. Phelps Archibald, Lynn, Mass. App. filed Oct. 8, 1891. The combination of a trolley wire, an electromagnet in circuit therewith, an armature arranged to be moved within the field of the magnet by the trolley, and to close the circuit through the magnet to hold it attracted, a signal in circuit with the magnet and a circuit-breaker for breaking the circuit.

552,001. UNDERGOUND CURRENT SUPPLY FOR ELECTRIC RAILWAYS; August Rast, Nuremburg, Germany. App. filed March 29, 1894. The combination with each feed section and its box of a main conductor, a section supply conductor, an electromagnet in the box, with whose coil the conductor is connected, a movable core in said magnet and a contact-piece on the core consisting of a spring to make yielding contact with the feed section and connected with the coil of said magnet.

552,036. MATERIAL FOR INCANDESCENT CONDUCTORS: Ludwig K. Bohm, New York, N. Y. App. filed Nov. 5, 1891. As a new article of manufacture, a compound of substance for electrical conductors consisting of a homogeneous mass of carbon and earth alkali metals forming a carbide.

552,053. ELECTRICAL SWITCH-OPERATING AND SIGNAL APPARATUS; Justin Dutrey, New Orleans, La. App. filed May 25, 1895. In an electric switch-operating apparatus, the combination of the main track rails, turnout rails, a switch point or points, an armature lever fulcrumed at an intermediate point of its length, a connection between said armature lever and the switch point or points, an electromagnet disposed so as to enable it when energized to draw the opposite end of the armature lever in the opposite direction, and a suitable means for energizing said electromagnets.

552,057. CIRCUIT-CLOSER AND BREAKER; John R. Farmer, St. Louis, Mo. App. filed Jan. 25, 1895. In an electric circuit-closer the combination of a trolley wire, a contact plate placed parallel with the trolley wire, the circuit connecting said contact plate through an electromagnet with a signal lamp, and a suitable return connection, the armature, having constant connection with the trolley wire, under control of the electromagnet, and adapted to close a circuit through said magnet, and suitable means for dropping said armature from a distant point.



NO. 551,998.—ELECTRIC SIGNAL.

552,059. ART OF MAKING ARMORED OR COMPOUND TUBES; Edwin T. Greenfield, New York, N. Y. App. filed May 16, 1895. A method of forming a compound tube, consisting in coating a surface of one of two tubes with a binding agent which will unite the two together when inserted the one within the other, and then forcing the one within the other.

552,060. ARMORED TUBE OR CONDUIT; Edwin T. Greenfield, New York, N. Y. App. filed May 16, 1895. As a new article of manufacture, an armor tube of metal and a prepared paper tube united together adhesively by an intermediate binding agent.